First Workshop Report

D5.1

AW-Drones

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Authoring & Approval

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Rejected By - Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date

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AW-Drones

CONTRIBUTING TO A WELL-REASONED SET OF AIRWORTHINESS STANDARDS FOR MASS-MARKET DRONES

Abstract

This document reports on the set-up and results of the first AW-Drones Workshop, detailing the issues identified and the resultant priorities.

The document is organized as follows: extensive minutes of the workshop including interactive discussions and participants' interventions are reported, while support materials including list of participants, presentations, pictures etc. are included in the form of Annexes.

All the personal data of the workshop participants have been collected, stored and managed following the Protection of Personal Data Policy of the project detailed in Deliverable 8.1.

Harmonizing Drone Standards - 1st Information Dissemination Workshop

Date: September 19, 2019
Hours: 10.00 – 12.00 & 13.00-16.45
Location: Brussels, Belgium
Venue: EUROCONTROL Headquarters

Participation: 79 persons - 56 Companies/Organisations - 19 Countries
Annex 1 – List of participants & organisations by country
Annex 2 – Alphabetical list of persons present

Stakeholder representatives (quantity of persons) from the following countries were present:

Belgium (20)	Bosnia & Herzegovina (1)	Cyprus (1)	Denmark (1)
France (7)	Germany (7)	Greece (2)	Italy (5)
Netherlands (12)	Poland (4)	Portugal (1)	Spain (1)
Switzerland (1)	United Kingdom (2)	USA (1)	

Objective: Review the project results and the mapping between relevant standards and the regulatory requirement to identify, with relevant stakeholders, priorities and needs for the European drone value chain.
Making use of online interactive sessions, share views with the project team, EASA and EUROCONTROL experts, the project officers of the European Commission and the workshop participants.

Agenda: **Annex 3**

Handouts: The following AW Drones documents were remitted to the workshop participants:
Annex 4 – Standards Classification Scheme
Annex 5 – Multi Criteria Analysis for the Assessment of Standards
Annex 6 – Assessment Criteria

10.00-10.15 **EUROCONTROL Welcome**

Julia Sanchez (EUROCONTROL) gave a short welcome speech and emphasized the importance of the work being conducted by AW Drones.

10.15-10.45 **AW Drones Project Overview**

Damiano Taurino (DeepBlue, Italy) opened the meeting and presented the meeting agenda & the event timing. He also highlighted the logistics (coffee breaks, lunch, and indicated that coffee break & lunch vouchers could be obtained from Vera Ferraiuolo.
An introduction to the AW Drones project approach and the cooperation with the stakeholders was given.
The objective is to collect the standards, principally airworthiness procedures (but not only). The principal starting point is the European UAS Standards Coordination Group (EUSCG) Rollout Development Plan, but also standards from all other standards making organization and from industry.
A short explanation of what the reasoning is behind the Meta-Standard is given.
It was indicated that if no standards are available, the gaps & bottlenecks, or immaturity will be identified.
The principal focus is on safety, but security will also be been taken into consideration.
The first year of the project addresses standards for specific operational risk assessment (SORA). Starting in January 2020, the project will be devoted to UTM/U-Space. Starting in January 2021, the project will address the standards needed to support highly automated

& autonomous aircraft.
The list of stakeholders to be involved (source of information & review of work in progress) was presented.
The importance and the various means of dissemination to be used was explained.
The first AW Drones online survey to collect data from a wider community is announced.
It is indicated that annual reports will be produced and made publically available on **www.aw-drones.eu**. An open repository will be created where all produced information will be made accessible to all.
All presentations given at the workshop will be made available.

- Presentation given: **See Annex 7**

10.45-11.00 **EASA Regulatory Status**

Natale Di Rubbo (EASA) gave an overview of their interest and implication in the project, and the needs of EASA relative to the project. He presented the EASA approach to its risk-based approach to rulemaking (open & specific categories).
Standards for the open category (CE marking) is not part of the current project; the focus is on the specific category where the operator is required to make a risk assessment based on SORA. The European SORA (adapted to European system) will be published in October 2019 and will be followed by the first 2 standard scenarios (operations for which a declaration is sufficient) requiring CE marking [2 additional classes (C5 & C6) will be required and will be the subject of an amendment to the Delegated Act].
EASA is preparing high level U-Space regulation and will define building blocks of the minimum services that must be deployed, the essentials that have to be deployed (identification, geo-awareness, air traffic information), responsibilities of the Member States, operators & service providers. This first draft U-Space regulation should permit to start to deploy some U-Space blocks in various countries.
EASA has developed a concept paper to define the scope of the certified category, including urban air mobility (point A to B); incremental approach: starting with a pilot on board and progressing in steps to automated/autonomous). If mature enough, the concept paper may be published on the EASA web site by the end of 2019; the NPA would then be scheduled for the 3rd quarter of 2020.

- Presentation given: **See Annex 8**

11.00-11.20 **Coffee Break**

11.20-12.00 **Workshop Objectives**

Marco Ducci (DeepBlue, Italy) introduces www.awdrones.eu and presents an overview the people present at the workshop. The workshop objectives are presented:

a) Raising awareness of what AW Drones is doing and involving the EU drone community.
b) The primary results will be presented, as well as the standards are collected and how they are classified. The large Excel file containing all 600 collected standards will be made available on **www.awdrones.eu** after approval by the EC.
c) The secondary main thing to be presented is the mapping of the SORA requirements.
d) Gather general feedback on the methodology used to possibly improve the future activities of AW Drones.

The purpose of the afternoon sessions and the methodology were explained.
The supporting material remitted to each participant was presented: agenda, classification

scheme (3 pages), multi criteria analysis for the assessment of the standards (2 pages), assessment criteria (5 pages).
The interactive tool (**www.menti.com**) to be used to obtain the feedback from the workshop participants was presented and its use was explained with real-time projection on the screen.
Logistics were explained (the use of the lunch voucher was explained, transport to central Brussels & the airport).
A very early concept of the standard repository was shown; it will also include the mapping.
The complete standards will not be available (they are covered by copyright); they are to be purchased from the standards development organisations.

Group Photo — On the way to the restaurant a group photo was taken.

- AW Drone Group Photo: **See Annex 9**

12.00-13.00 **Lunch**

13.00-13.45 **Drone Standards State-of-the-Art**

Sabastian Caen (DLR, Germany) introduces how the standards are collected and classified.
The purpose of the task and the data sources are explained. The data collection serves to collect all drone-related standards in all states of maturity (used, printed, drafted, creation ongoing & envisaged), to contribute to permitting EASA and the EC to create the drone regulatory framework and create the linkage between the upcoming regulations and the collected standards that can support the regulation.
The contribution sources relative to the data collection are indicated.
The structure (domains, sub-topics) of the database was presented. It was highlighted that the standard applicability to each drone class (open, specific, certified) will be indicated.
The new proposed keyword system (with new domains) was presented. It was pointed out that up to 3 keywords can be linked to a domain. “Systems & Equipment” will have a second level of keywords.
The mapping (steps) of the SORA requirements is explained.
The current Excel file structure was presented – 50% of the 600 standards have currently been mapped.

Q: What are “mass market drones” and why is this term used?
A: The original reason for the use of this term is historical (it was used in the Call for Tender). The importance of terminology and its correct use is confirmed.

- Presentation given: **See Annex 10**

13.45-14.30 **First Interactive Session & Feedback**

Feedback on Classification:
Questions projected and comments are submitted by app (**www.menti.com**)

Question 1 **Your opinion in important**
Overview of results gathered with online survey tool:

Evaluation Score: 1 is Low & 5 is High	1	2	3	4	5	WA
There is a lack of technical standards for drones	2	3	7	18	11	3,8
Lack of standards is holding back drone business in EU	2	2	11	15	11	3,76

Note: WA = Weighted Average

◆ Questions & Conclusions: **See Annex 11**

Comments

- There is no lack of standards, but a lack of knowledge with the industry which standards apply to them.
- This is specifically the case relative to the “open” & “specific” category (not the certified category).
- There will be a European norm (CE marking) published in 2021 for the “Open” category defined by ASD-STAN (the only SDO mandated to produce these standards). AW Drones will not cover the standards for the “Open” category.
- AW Drones currently has 600 standards; the problem is not the quantity, but we require standards with a more common approach.
- The pre-standards (CE marking) for the “Open” category will be published mid-2020 and the final standards in 2021; we suffer a lack of mapping between the standards and the regulation requirements.
- We are lacking a significant number of standards for the “specific” category.
- Which of the currently referenced 600 standards are actually accepted/approved by a national aviation authority. Less than 10. The adoption and applicability is of importance.
- In JARUS, standards covering some of the key SORA requirements have not been identified.
- How far will AW Drones go in the analysis in order to map the standard and the SORA requirements? This will be much clearer in the next session.

Question 2 **Which is the domain with the highest need for well-defined standards?**
The domain key words are projected.
The audience is requested to rank them in order of importance.

Rank of choice	1st	2nd	3rd	4th	5th	6th	7th	8th
General	0	2	0	2	2	1	7	9
Initial Airworthiness (at UAS level)	15	5	9	0	3	0	1	1
Continuing Airworthiness	0	3	5	5	4	7	1	0
UAS Operations	14	16	2	3	1	2	0	0
Aerodromes	1	2	2	2	1	7	5	5
U-Space/ATM	15	5	9	2	3	0	1	0
Personnel	1	5	6	5	4	4	3	0
Oversight	1	2	1	7	4	1	4	6

◆ Questions & Conclusions: **See Annex 11**

Comments

- Standards relative to air risk are important. There is a gap to fill between now and the date of maturity of UTM, especially for BVLOS ops. An intermediate solution is suggested.
- Standards produced by operational stakeholders (operators) – not by standards producing bodies – are not taken into account. Operational standards have been

produced for the use of drone in the offshore industry in UK and now taken over in the USA.

- Such standards should be submitted by the UK industry to the national UK standards organization, who would then be able to feed it into the ISO effort.
- When the offshore industry produces such standards, the main driver is insurance.
- How do we operate drones and what is the U-Space seems to be the principal pre-occupation. The most important standards are those that enable operations.
- How is the use of correct standards verified? Who approves compliancy with the standards? The entire process for the various risk levels (low, medium, high) is explained by EASA.
- There is already a lot of activity in the U-Space/ATM field. There are no standards relative to the phraseology in communication with ATM and scalable radio communication with ATM do not exist. The segregation standards between manned and unmanned aircraft do not exist.
- What is the current status relative to aerodromes and electrical VTOL? Certain airports are interested in standards for vertiports, which are already being programmed. EUROCAE announces the creation of a specific working on this subject.
- Should the term “airworthiness” be maintained? We are talking about aircraft with not receive an airworthiness certificate. For the moment the term airworthiness will be maintained by EASA, but an alternative term can be proposed.
- The legal definition of airworthiness does not exist. In the current situation, we are talking about verification of compliance with a certain standard and is in a safe condition to fly.

Question 3 **Are we missing something? Suggest your domains or keywords** (2 max)

A word cloud is projected.

Reference is made to the keywords and suggestions for what is missing.

The following responses were received (alphabetical order):

- Accommodation - Batteries - Connectivity supplementary data - Cyber security - Design appraisal - Detect and avoid insurance - Emergency response plan - Existing licence (conversion) - Experimental Detect & Avoid - Flight Data recording - Flight termination system - Flight planning - Future operations - Geo-fencing - Ground station - Health monitoring - Highway observation - Human machine interface	- Information criteria - Insurance - Navigation requirements - Ops-ATS Communication – Non-cooperative - Pre-flight Info Bulletin - Probable failure - Remote direct identification - RNP for small UAS - RNP Procedures for UAS - Separation - Sustainability - System connectivity - Tools for law enforcement - UAS Aviation Security - UAS maintenance - UAS operations - VLL Vertiports

◆ Questions & Conclusions: **See Annex 11**

Comments

- What the difference between sustainability and environment.
- Some of the suggestions are valid, others are already mentioned with different words.
- Insurance is going to be a major decision-influencing factor. Would it be possible to make insurance validity conditional on the use of some specific operational standards?
- Law enforcement tools should be the same (comply with the same standards) in all EU countries. It would be helpful if there was a standard for the documents that an operator working outside his country has to have with him on a daily operation.
- Requirements (and standards) for UAS operations: Requirements have to be defined for traditional CNS infrastructure for navigation, consequently the relevant standards are required.
- This is one of the reasons why AW Drones has moved from the slightly rigid domain & sub-domain approach in order to be able to adapt to the transversality of some topics and keep trace of these topics.
- A proposal is presented: Required navigation specifications for small drones at very low level (specific category – below ICAO standards) based on performance-based regulation and develop standards through industry.

Question 4 **Is there a specific standard you would like to suggest for consideration by AW-Drones?**
No specific list is presented.
The attendees are requested to input suggestions for specific standards.
No inputs were supplied prior to the coffee session. The survey system was left open to receive inputs from the audience during the following 20 minutes.

The following standards were proposed (in alphabetical order):

- ASTM Remote ID	- ISO 23629-12
- ATS Phraseology	- ISO 23665
- Autonomy Certification GM	- ISO 9241-303
- Cyber Security	- Law Enforcement
- Emergency Response Plan	- Personnel Training
- Flight termination system	- Remote Direct Identification
- GNSS Guidelines for UAS	- Scalable ATS Communication
- ISO 17025	- UAS Neutralization
- ISO 20000	- Urban Mobility
- ISO 21384-5	- Vertiports

◆ Questions & Conclusions: **See Annex 11**

14.30-14.50 **Coffee Break**

14.50-15.30 **Overview of Mapping between Standards and SORA Requirements**

Matteo Carta (EuroUSC Italia, Italy) introduces the concept of meta-standard, a tool developed for the stakeholders to find their way through the large amount of standards now available, and in particular focusing on the SORA requirements. He subsequently uses a PPT to explain how the assessment is made.

Conclusion: A good amount of standards have been assessed and some potential mapping and major gaps have been identified. We still have to consolidate the gap analysis and look at other standards.

Comments

Q: How does AW Drones establish that IATA & JARUS are standard making organisations?
A: They are not standard making organisations, but we have recognized that there is a lack of applicable standards produced and we have taken certain documents of other organisations into account for this reason.
Q: How does AW Drones take into account the different levels of robustness into the OSOs?
A: This aspect was not relevant for the examples given. However, we will perform the assessment trying to identify the suitable standards compliant the various levels of integrity. How do you take into account that a standard is considered adequate?
Q: Does the level of maturity of standard take into account if it is adopted by a NAA?
A: The development process of standards is different between standard making organisations, but we have recognized 5 different common levels of maturity: drafting stage, internal consultation, external consultation, published, accepted & used by authorities.

- Standards do not have to be adopted by an authority; if there is evidence that they have been accepted by the authority, that is enough.
- Out of the 600 currently indexed standards how many have actually been accepted by a national aviation authority? Less than 25. This is one reasons for the existence of AW Drones, namely to make EASA actually accept certain standards.

Q: What is the role of the keywords for the classification of the standards in the assessment process? There is concern is that if there is a lack of or error in the allocation of the keywords that there might be a risk that the standard will be negatively assessed.
A: The first mapping was very broad; this mapping is used to identify which standards have to be assessed in detail. The keywords are simply a way to group the standards so they can be retraced.

- The repository will be a living document. Everybody has to agree on the methodology. JARUS is also evaluating this methodology to make it accepted worldwide.

Q: If the AW Drones methodology identifies that a particular non-finalized standard does not fulfil a requirement or falls into a “not to be further considered” category, will the standard producing body producing that standard be notified?
A: The results will be published as soon as possible and be made available to all standard making bodies on the consortium’s web site (www.aw-drones.eu).
Q: Will AW Drones consider contacting the experts that have been or are still involved with making the standards in standards producing organisations to bring their technical expertise into AW Drones to get assistance in technically assessing the standards contemplated by AW Drones?
A: AW Drones does not really technically assess the standards – only EASA can do that. AW Drones checks if the scope of the standard covers the requirements and up to what level. Only EASA can decide if it is an acceptable standard (in coordination with standard making bodies) and the European Standards Coordination Group, and can decide how the gap can be covered, or if a new standard has to be developed.

◆ Presentation given: **See Annex 12**

15.30-16.00 **Second Interactive Session and Feedback**

Overview of results gathered with online survey tool.

Question 1 **Your view is important**:

Evaluation Score: 1 is Low & 5 is High	1	2	3	4	5	WA
The AW-Drones methodology is clear	0	1	5	19	8	4,03
MCA is right tool to assess drone standards	1	1	7	14	8	3,87
The outcomes will be useful for my work	2	0	4	5	22	4,36

Note: WA = Weighted Average

The following criteria were indicated as missing (listed alphabetically):

- Adoption - Adoption Outside EU - Adoption Overlap - Affected Stakeholders - Already Successfully Used - Authority Acceptance - Authority Acceptance - Ease of Use - Complexity - Maintainability - Maturity Acceptance by NAA	- Performance Based - Potential Scope Criticality - Quantity of NAAs Accepting It - Safety Applicability - Simplicity & Clarity - Safety Simplicity - Clarity & Applicability - Scaleability - Sustainability Extra-EU - Technology agnostic harmonised internationally consistent terminology - Usability as an AMC

Question 2 **How do you weigh the assessment criteria?**

Evaluation Score: 1 is Low & 5 is High	**1**	**2**	**3**	**4**	**5**	**WA**
Effectiveness to fulfil KPA (e.g. Safety) requirement	1	0	1	11	27	4,58
Maturity	4	5	11	12	8	3,38
Type	12	10	10	5	0	2,22
Cost of compliance	4	6	9	16	5	3,3
Environmental Impact	7	11	13	7	2	2,65
Impact on EU industry competitiveness	10	7	9	11	3	2,75
Social acceptance	16	7	6	6	4	2,36

Comments

Q: How does AW Drones assess that a standard applied is actually reliable enough.
A: Users (manufacturers & operators) of the published standard can inform AW Drones on their possible reservations, and these comments/limitations can be included in the assessment.
Q: How do you weigh the effectiveness of the assessment criteria of a standard? How should they be ranked? What is meant the “type”?
A: Standard specification, guidance material, best practice.

◆ Questions & Conclusions: **See Annex 13**

16.00-16.15 **ANSI UAS Standardization Collaborative (UASSSC) Overview**

Sara Gobbi (Brussels office of ASTM International, USA) gives a PPT presentation on behalf of Philip Kenul, ASTM F38 Committee Chair + member of the ANSI UAS Collaborative.
There are some similarities between the ANSI UAS Collaborative and the AW Drones project. AW Drones is mapping existing standards against SORA requirements. The ANSI initiative is defining a list of standards that are required by industry. A first roadmap has been published and is publically available at **http://www.ansi.org/uassc**. A second edition of this roadmap will be published by the end of June 2020, which will conclude the second phase of the project.

Comments

- The scope of the ANSI project concerns standards for industry (bottom-up), whereas AW Drones concerns standards for safety (top down). If both groups have the same opinion on the identified gaps, this will create confidence with both organisations that they are the right path.

◆ Presentation given: **See Annex 14**

16.15-16.45 **Introduction to the European UAS Standards Coordination Group (EUSCG)**

Natale Di Rubbo (EASA) explained the background, participants, activities (the Rollout Development Plan) of the EUSCG. The objective of this group (consisting European & American standards producing bodies) is to produce and maintain up-to-date a list of identified drone-related standards and requirements that are currently available. This document is available on the web site (**www.euscg.eu**). The current list consists only of the full list of the standards without the link to the requirements.
AW Drones is complementing the work carried out by the EUSCG by identifying the gaps. The EUSCG will then identify which standard making body is best suited to produce the necessary standards.

◆ Presentation given: **See Annex 15**

Final Discussion & Wrap-Up

Feedback on the organization of the workshop and opinions on the next steps was collected by means of the online survey tool.

◆ Questions & Conclusions - **See Annex 16**

Closing comments

- AW Drones will deliver to the EC the first version of the results of the assessment.
- At the end of 2019, AW Drones will publish its annual report, which will be made publically available.
- Announcement of the upcoming online survey – all workshop attendees will receive a link. This survey will also be made available to a much wider stakeholder community.
- Thanks is expressed to EUROCAE for hosting the event, and to all attendees for participating and contributing.

ANNEX 1 - WORKSHOP PARTICIPANTS - BY COUNTRY & COMPANY/ORGANISATION

Country	Company / Organisation	Family Name	First Name	AWD Mbrs
Belgium	Aerosapce and Defence (ASD)	Scott	Benjamyn	
Belgium	ASD-STAN	Aliyeva	Pari	
Belgium	ASD-STAN	Mazel	Ariane	
Belgium	ASTM International	Gobbi	Sara	
Belgium	DeltaCopter	Gerard	Matthieu	
Belgium	Drone Manufacturers Alliance Europe (DMAE)	Iwaniuk	Paula	
Belgium	EC - INEA	Cid-Bourie	Vladimir	
Belgium	European Commission	Violato	Daniele	
Belgium	European Commission DG GROW	Aguilera	Miguel	
Belgium	European Defence Agency	del Valle	Juan Ignacio	
Belgium	EuroUSC-Benelux	Maes	Michael	
Belgium	Goldy Aviations	De Rycker	Geert	
Belgium	Helicus	Vanhandenhove	Geert	
Belgium	ID2MOVE	Patrick	Mascart	
Belgium	Politics Matters	Tulkens	Peter	
Belgium	UAS Consulting	Tesija	Igor	
Belgium	Unifly	Rogojina	Irina	X
Belgium	Unifly	Schrauwen	Hans	X
Belgium	Unifly	Williame	Koen	X
Belgium	Vives University College of Applied Sciences	Buysschaert	Ruben	
Bosnia & Herzegovina	Civil Aviation Authority (BHDCA)	Vučić	Darko	
Cyprus	Flight Safety Foundation	Rafael	Christodoulos	X
Denmark	Southern University of Denmark	Andersen	Klavs	
France	ADP Ingénierie	Martin	Franck	
France	Blyenburgh & Co (B&C)	van Blyenburgh	Peter	X
France	Bureau de Normalisation de l'Aéronautique et de l'Espace	Benmeziane	Ouissem (Karim)	
France	Delair	Faur	Gregoire	X
France	EUROCAE	Vallée	Alain	
France	EUROCONTROL	Hoffman	Eric	
France	Thales	Gucemas	Manuel	
Germany	DJI	Liebsch	Ronald	X
Germany	DLR	Cain	Sebastian	X
Germany	Drone Industry Insights	Radovic	Millie	
Germany	EASA	Di Rubbo	Natale	
Germany	flyXdrive GmbH	Schütt	Marten	
Germany	Hamburg Port Consulting	Gronstedt	Matthias	
Germany	Third Element Aviation	Schröder	Marius	
Greece	Centre For Research & Technology Hellas (CERTH)	Angelakakis	Angelos	X
Greece	Centre For Research & Technology Hellas (CERTH)	Tromaras	Alkiviadis	X

Country	Company / Organisation	Family Name	First Name	AWD Mbrs
Israel	Civil Aviation Authority	Manor	Adam	
Israel	Israel Aerospace Industries (IAI)	Hellman	Noam	X
Italy	Deep Blue	Ferraiuolo	Vera	X
Italy	Deep Blue	Taurino	Damiano	X
Italy	Deep Blue Srl	Ducci	Marco	X
Italy	EuroUSC Italia	Carta	Matteo	X
Italy	EuroUSC-Italia	Tomasello	Filippo	X
Netherlands	AirHub	van Vuren	Stephan	
Netherlands	BreatheDigital B.V.	Grandhi	Ram	
Netherlands	Drones for Work	Crone	Mathijs	
Netherlands	EuroUSC-Benelux	Vandormael	Thomas	
Netherlands	Fusion Engineering	Crone	Robert	
Netherlands	Geo Infra	De Jong	Jarno	
Netherlands	NLR	Boer	Jan-Floris	X
Netherlands	NLR	Brants	Johannes (Hans)	X
Netherlands	NLR	van Birgelen	Tom	X
Netherlands	NLR	Vreeken	Joost	X
Netherlands	RPAS Services	Muller	Rudy	
Netherlands	TU Delft	Ellerbroek	Joost	X
Poland	Lufthansa Systems	Golaszewski	Krzysztof	
Poland	Lukasiewicz Research Network Inst. of Aviation	Gołąbek	Michał	
Poland	Lukasiewicz Research Network Inst. of Aviation	Idzikowska	Teresa	
Poland	Lukasiewicz Research Network Inst. of Aviation	Mazur	Anna	
Portugal	TU Delft	Ribeiro	Marta	X
Spain	Agencia Estatal de Seguridad Aérea (AESA)	Fernández Varela	Diego	
Switzerland	Global UTM Association (GUTMA)	Lukácsy	Fanni	
UK	Ortelio Ltd	Trochidis	Ilias	X
UK	University of Kent	Mckenna	Alan	
USA	ASTM International	Kenul	Philip	

ANNEX 2 - WORKSHOP PARTICIPANTS - ALPHABETICAL BY NAME

Family Name	First Name	Affiliation	Country	AWD Mbrs
Aguilera	Miguel	EC DG GROW	Belgium	
Aliyeva	Pari	ASD-STAN	Belgium	
Andersen	Klavs	Southern University of Denmark	Denmark	
Angelakakis	Angelos	Centre For Research & Technology Hellas (CERTH)	Greece	X
Benmeziane	Ouissem (Karim)	Bureau de Normalisation de l'Aéronautique et de l'Espace	France	
Boer	Jan-Floris	NLR	Netherlands	X
Brants	Johannes (Hans)	NLR	Netherlands	X
Buysschaert	Ruben	Vives University College of Applied Sciences	Belgium	
Cain	Sebastian	DLR	Germany	X
Carta	Matteo	EuroUSC Italia	Italy	X
Cid-Bourie	Vladimir	EC - INEA	Belgium	
Crone	Mathijs	Drones for Work	Netherlands	
Crone	Robert	Fusion Engineering	Netherlands	
De Jong	Jarno	Geo Infra	Netherlands	
De Rycker	Geert	Goldy Aviations	Belgium	
del Valle	Juan Ignacio	European Defence Agency	Belgium	
Di Rubbo	Natale	EASA	Germany	
Ducci	Marco	Deep Blue Srl	Italy	X
Ellerbroek	Joost	TU Delft	Netherlands	X
Faur	Gregoire	Delair	France	X
Fernández Varela	Diego	Agencia Estatal de Seguridad Aérea (AESA)	Spain	
Ferraiuolo	Vera	Deep Blue	Italy	X
Gerard	Matthieu	DeltaCopter	Belgium	
Gobbi	Sara	ASTM International	Belgium	
Gołąbek	Michał	Lukasiewicz Research Network Inst. of Aviation	Poland	
Golaszewski	Krzysztof	Lufthansa Systems	Poland	
Grandhi	Ram	BreatheDigital B.V.	Netherlands	
Gronstedt	Matthias	Hamburg Port Consulting	Germany	
Gucemas	Manuel	Thales	France	
Hellman	Noam	Israel Aerospace Industries (IAI)	Israel	X
Hoffman	Eric	EUROCONTROL	France	
Idzikowska	Teresa	Lukasiewicz Research Network Inst. of Aviation	Poland	
Iwaniuk	Paula	Drone Manufacturers Alliance Europe (DMAE)	Belgium	
Kenul	Philip	ASTM International	USA	
Liebsch	Ronald	DJI	Germany	X
Lukácsy	Fanni	Global UTM Association (GUTMA)	Switzerland	
Maes	Michael	EuroUSC-Benelux	Belgium	
Manor	Adam	Civil Aviation Authority	Israel	

Martin	Franck	ADP Ingénierie	France	
Mazel	Ariane	ASD-STAN	Belgium	
Mazur	Anna	Lukasiewicz Research Network Inst. of Aviation	Poland	
Mckenna	Alan	University of Kent	UK	
Muller	Rudy	RPAS Services	Netherlands	
Patrick	Mascart	ID2MOVE	Belgium	
Radovic	Millie	Drone Industry Insights	Germany	
Rafael	Christodoulos	Flight Safety Foundation	Cyprus	X
Ribeiro	Marta	TU Delft	Portugal	X
Rogojina	Irina	Unifly	Belgium	X
Schrauwen	Hans	Unifly	Belgium	X
Schröder	Marius	Third Element Aviation	Germany	
Schütt	Marten	flyXdrive GmbH	Germany	
Scott	Benjamyn	Aerosapce and Defence (ASD)	Belgium	
Taurino	Damiano	Deep Blue	Italy	X
Tesija	Igor	UAS Consulting	Belgium	
Tomasello	Filippo	EuroUSC-Italia	Italy	X
Trochidis	Ilias	Ortelio Ltd	UK	X
Tromaras	Alkiviadis	Centre For Research & Technology Hellas (CERTH)	Greece	X
Tulkens	Peter	Politics Matters	Belgium	
Vallée	Alain	EUROCAE	France	
van Birgelen	Tom	NLR	Netherlands	X
van Blyenburgh	Peter	Blyenburgh & Co	France	X
van Vuren	Stephan	AirHub	Netherlands	
Vandormael	Thomas	EuroUSC-Benelux	Netherlands	
Vanhandenhove	Geert	Helicus	Belgium	
Violato	Daniele	European Commission	Belgium	
Vreeken	Joost	NLR	Netherlands	X
Vučić	Darko	Civil Aviation Authority (BHDCA)	Bosnia & Herzegovina	
Williame	Koen	Unifly	Belgium	X

AW DRONES

19 SEPTEMBER 2019

Harmonising drone standards
First Workshop

AW-Drones is an H2020 project that contributes to the harmonisation of the EU drone regulations and standards. The project supports the European Union rulemaking process for the definition of rules, technical standards and procedures for civilian drones to enable safe and reliable operations in the EU Open and Specific categories.

OBJECTIVES

The workshop objectives are to review the project results and the mapping between relevant standards and regulatory requirement to identify, with relevant stakeholders, priorities and needs for the European drone value chain.

During interactive sessions, participants will have the opportunity to share their views with the project team, EASA and EUROCONTROL experts and the Project Officers from the European Commission.

AGENDA

9.30-10.00	Registration and welcome coffee
10.00-10.15	EUROCONTROL Welcome
10.15-10.45	AW Drones project overview
10.45-11.00	EASA Regulatory status
11.00-11.20	Coffee break
11.20-12.00	Workshop objectives
12.00-13.00	Lunch
13.00-13.45	Drone standards state-of-the-art
13.45-14.30	Interactive session and feedback collection
14.30-14.50	Coffee Break
14.50-15.30	Overview of mapping between standards and SORA requirements
15.30-16.00	Interactive session and feedback collection
16:00-16.15	ANSI UAS Standardization Collaborative (UASSC) overview
16.15-16.45	Final discussion and Wrap-up

Standards classification scheme

1 of 3

Domains	Keywords Level 1	Keywords Level 2
General	Definitions	
	Classification of UAS operations	
	Classification of drones	
	Manuals	
Initial Airworthiness (at UAS level)	Flight performance	
	Limitations	
	Structures	
	Design & Construction	
	Power Plant Installation	
	Electrical System	
	Noise & Environment	
	Level of Automation/Autonomy	
	Software Development Assurance	
	Airborne Electronic Hardware (AEH) Development Assurance	
	Remote Pilot Station (RPS)	
	Systems safety assessment	
	Accident/Incident investigation	
	Systems & Equipment	Emergency capabilities & Health monitoring
		ATS Communication
		Detect and Avoid
		Navigation
		Lights
		Instruments
		Traffic surveillance (tracking)
		Command and Control (C2) Link
		Environmental qualification of Equipment (Ground and Airborne)
	Manuals	
	HMI	
	Human Factors	
	Cyber-security	
	Organization	
Continuing Airworthiness	Instructions for continued airworthiness	
	Manuals	
	Organization	
	Human Factors	
	UAS Maintenance personnel competence	

Standards classification scheme
2 of 3

UAS Operations	Manuals
	Organization
	Level of Automation/Autonomy
	Physical Security
	Privacy and data protection
	UAS Operator
	C2 Link Service Provider
	RPS Service Provider
	Standard Scenarios
	Accident/Incident investigation
	Safety data collection and analysis
	UAS-ATM (IFR above VLL and below FL 600)
	Risk Assessment (Operations)
	Human Factors
	Take-off/Landing zones (urban vertiports)
	Marking and Registration
	E-Identification
	U-Space Service Providers
	Tracking
	Geo-awareness
	Cyber-security
	HMI
Aerodromes	Manuals
	Organization
	Level of Automation/Autonomy
	Aerodrome operator
	Take-off/Landing zones (urban vertiports)
	Ground Handling Service

Standards classification scheme

3 of 3

U-Space/ATM	Manuals
	Organization
	Privacy and data protection
	Level of Automation/Autonomy
	C2 Link Service Provider
	RPS Service Provider
	Standard Scenarios
	UAS-ATM (IFR above VLL and below FL 600)
	Take-off/Landing zones (urban vertiports)
	Ground Handling Service
	Marking and Registration
	E-Identification
	U-Space Service Providers
	Tracking
	Geo-awareness
	Cyber-security
	HMI
Environment	Aircraft Noise Emission
	Aircraft gaseous emissions
	Cumulative noise around vertiports
Personnel	Manuals
	Organization
	Instructors
	Examiners/Assessors
	Training organizations
	Human Factors
	UAS Maintenance personnel competence
	Remote Pilot competence
	Additional crew members competence (non-regulated professions)
Oversight	Manuals
	Organization
	UAS Operator
	C2 Link Service Provider
	RPS Service Provider
	U-Space Service Providers
	Notified bodies and Qualified Entities

Multi Criteria Analysis for the assessment of the standards

1 of 2

CASE 1: **Standards potentially suitable to comply with a given requirement**

STEP #1: STANDARD ASSESSMENT

weight

- Effectiveness to fulfill KPA requirement
- Maturity
- Type
- Cost of compliance
- Environmental impact
- Impact on EU Industry competitiveness
- Social acceptance

STEP #2: CASE 1 CONCLUSIONS

C — **SCORE RANGE C**
Standard is recommended as preferred AMC.

B — **SCORE RANGE B**
Standard listed as possible AMC subject to decision by Authority (on a case-by-case basis).

A — **SCORE RANGE A**
Identify possible applicable standards from other industry segments (e.g. automotive); or
Recommend the amendment of the standard.

Scoring system

CRITERION X	-2	-1	0	1	2

CASE 2: **No standard suitable to comply with a given requirement**

STEP #1: ASSESSMENT OF GAP CONSEQUENCES

weight

- Safety or other KPA
- Cost of compliance (to the requirement given the lack of standards)
- Environmental impact
- Impact on EU Industry competitiveness
- Social acceptance

STEP #2: CASE 2 CONCLUSIONS

B — **SCORE RANGE B**
Identify applicable standards from other industry segments (e.g. automotive); or
Recommend the development of a suitable standard.

A — **SCORE RANGE A**
No actions to be undertaken.

Scoring system

CRITERION X	-2	-1	0	1	2

Multi Criteria Analysis for the assessment of the standards

1 of 2

CASE 3: **Standards not mapped to any requirement**

STEP #1: STANDARD ASSESSMENT

weight

- Effectiveness to fulfill KPA requirement
- Maturity
- Type
- Cost of compliance
- Environmental impact
- Impact on EU Industry competitiveness
- Social acceptance

STEP #2: CASE 3 CONCLUSIONS

B

SCORE RANGE B
Definition of a new requirement to be mapped with the standard is recommended.

A

SCORE RANGE A
No actions to be undertaken.

Scoring system

CRITERION X	-2	-1	0	1	2

Assessment criteria
Case #1
1 of 3

STEP #1: STANDARD ASSESSMENT

Description

CRITERION:
Maturity

Although the exact wording may differ, all organisations/groups involved in developing standards apply a similar process, or work flow. In essence the following development phases can be distinguished:

- Drafting
- Internal Consultation
- External Consultation
- Published
- Accepted by EU Authorities/FAA

Scoring

-2	-1	0	1	2
Drafting	Internal Consultation	External Consultation	Published	Recognized / Accepted / Used

STEP #1: STANDARD ASSESSMENT

Description

CRITERION:
Type of standard

The type of the standard is considered to be a measure for the applicability of that standard. For this purpose three types of standards are identified:

- Information guidance
- Best practice
- Standard Specification

Scoring

-2	-1	0	1	2
N.A.	N.A.	Information Guidance	Best Practice	Standard Specification

Assessment criteria
Case #1
2 of 3

STEP #1: STANDARD ASSESSMENT

Description

CRITERION:
Effectiveness to fulfill KPA requirement

This criterion will address the effectiveness of the candidate standard to fulfil a given requirement with respect with its relevant Key Performance Area (e.g. Safety, Security)

The primary material on which the assessment of a standard will be performed will be the beginning of the standardisation document, i.e. sections such as the abstract, scope, applicability and background information.

It will be assessed to what extent the standard covers a requirement: low, medium, high or full coverage.

In case of an incomplete coverage the applicant must demonstrate by other means that the requirement is met. There is a risk that missing aspects will be overlooked by either the applicant or the regulator.
At this stage, it is conservatively assumed that the missing aspects are overlooked. Therefore partial coverage and full coverage of a requirement corresponds with respectively a neutral and positive effect on KPAs.
In case of partial coverage of a requirement the gaps must be indicated.

Scoring

-2	-1	0	1	2
N.A.	N.A.	Partial coverage	N.A.	Full coverage

Assessment criteria
Case #1
3 of 3

STEP #1: STANDARD ASSESSMENT

Description

CRITERION:
Cost of compliance

The objective of this criterion is mainly to assess and quantify the feasibility and practicability for the drone industry of adopting a certain standard. Cost of compliance is a metric to measure them.

All costs incurred to comply with the selected standard shall be identified and quantified at a qualitative level. The analysis should consider all affected stakeholders such as: Manufacturers, Maintenance organisations, Training organisations, Operator organisations, Remote pilots, Regulators, Oversight authorities, General public.

The assessment should include (as a minimum):

- Development costs incurred to develop a product/system compliant with the standards (e.g. Cost for manufacturers to develop a DAA compliant with EUROCAE/RTCA standard, or an entire UAS compliant with CS-UAS or ISO UAS product standard. Cost for training organization to develop a training course compliant with ASTM standard, cost for Remote Pilots to get a license).
- Operational costs related to the limitations coming from the applicability of the selected standard (e.g. if a standard is applicable only to operations in uncontrolled airspace, there is a cost for the operator that cannot fly in controlled airspace. If a standard is applicable only to rotorcraft, there is a cost related to the efficiency of operations requiring to fly long distances and more suitable for fixed-wing drones).
- Time required to complete the development of all products/systems/infrastructures required to comply with the selected standard (e.g. time for Remote Pilots to obtain a license in line with a selected training standard, time for manufacturers to implement production processes that allows to produce UAS compliant with CS-UAS).
- Compatibility/consistency with existent standards should be considered as a way to reduce overall costs by possibly reusing products/systems/technologies already developed.
- Both one-off and recurring costs shall be identified.

All the costs and resources listed here should be measured or derived with an expert judgement taking into consideration the different magnitude and business case of the considered stakeholders. Costs considerations will cover the sustainability and feasibility of the adoption of the considered standard for a certain organization, rather than the absolute value of the sustained costs (e.g. Airbus and DJI may have very different costs for the production of a certain component but with a similar affordability within their respective business cases).

Scoring

-2	-1	0	1	2
Very High	High	Medium	Low	Very Low

Assessment criteria
Case #1
3 of 3

STEP #1: STANDARD ASSESSMENT

Description

CRITERION:
Environmental impact

Effects on emission of greenhouse gases; noise nuisance; energy and fuel consumption. Effect on areas, scenic view, and resources. Likelihood of causing fires, explosions or accidents. Effects on (local) fauna.

Impact can be beneficial, neutral or harmful. For example, a standard directed at reducing consumption of resources has a beneficial impact. On the other hand, a standard may be harmful when, for instance, it induces high noise nuisance or fuel consumption. Standards are expected to have mostly a neutral impact.

Scoring

-2	-1	0	1	2
Bad	N.A.	Neutral	N.A.	Good

STEP #1: STANDARD ASSESSMENT

Description

CRITERION:
Impact on EU Industry competitiveness

This criterion defines the impact (both positive and negative) of the adoption of the selected standard on EU industrial stakeholders (manufacturers, operators, service providers, etc.) competitiveness. The analysis should consider all affected stakeholders and include (as a minimum):

- Cost of compliance specifically for the European stakeholders (high costs mean a negative impact);
- Readiness of EU industry in adopting the standard (long times for adoption lead to a negative impact);
- Readiness of EU aviation authorities (EASA and NAAs) in adopting the standard (long times for adoption lead to a negative impact);
- Potential benefits for EU manufacturers of certifiable technologies (positive impact) or need to rely on non-EU manufacturers to integrate certifiable technology (negative impact);
- Both one-off and recurring costs and benefits for EU industry shall be identified.

Scoring

-2	-1	0	1	2
Very negative	Negative	No impact	Positive	Very positive

Assessment criteria
Case #1
3 of 3

STEP #1: STANDARD ASSESSMENT

Description

CRITERION:
Social Acceptance

Social acceptance shall identify behavioural change caused from a selected standard and its content that is being assessed. It assesses:

- The attitude change or the degree to which people receive favourably or negatively a standard and the measures it introduces.
- Is there acceptance of the standard and its measures by the stakeholders?
- Any positive or negative impact on society. Does it have an impact on job creation and demand for labour or improvement in job quality?
- What benefit does it bring to the end user but also to society? Is there an impact on employment like making dirty jobs redundant
- Does the standard have an adverse impact due to strict regulations
- Does the standard affect market penetration of drones thus making them more acceptable
- Does the standard introduce measures that make drones easier to use for certain applications

Scoring

-2	-1	0	1	2
Very negative	Negative	No impact	Positive	Very positive

AW DRONES

Project Overview

Damiano Taurino – Project Coordinator

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Outline

What is AW-Drones?

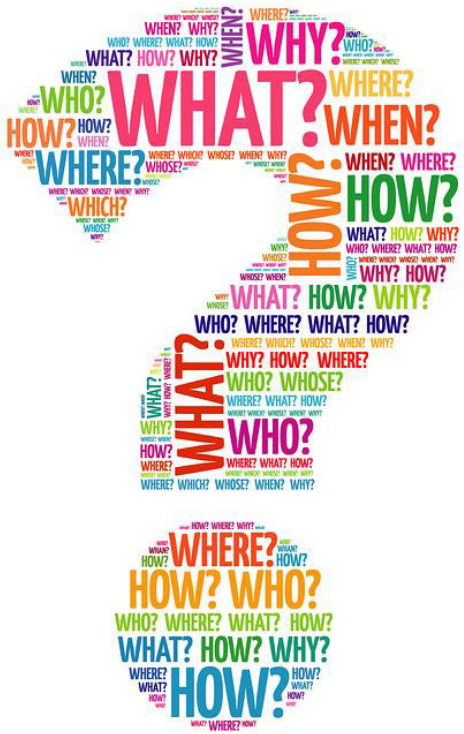
Objectives

Methodology

Scope

Involvement of external experts

Expected Outcomes



This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

What is AW-Drones?

AW-Drones is a **3-years** Coordination and support action (CSA) funded under the EU H2020 program.

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

deepblue

EUROUSC ITALIA

DLR

nlr

FLIGHT SAFETY FOUNDATION MEDITERRANEAN "Never take safety for granted"

HELLENIC INSTITUTE OF TRANSPORT CERTH / HIT

TU Delft

ortelio

dji

DELAIR AERIAL INTELLIGENCE

UNIFLY

IAI

Objectives

- **Collect information** on on-going and planned work with regards to technical and operational **standards** developed for drones worldwide
- Carry out a **critical assessment/benchmarking** of all collected data to identify best practices, gaps, bottlenecks and applicability
  … in other words a "metastandard"
- Propose and **validate** a well-reasoned set of standards for each category of drone operations
- **Engage** with key stakeholders and end-users, i.e. representatives of the whole drone value chain

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Methodology – Collecting and categorizing

Collection of drone standards

→ **airworthiness**, operations & procedures, ….

EUSCG RDP
ANSI Roadmap

Collection of drone-related and applicable general standards

EUROCAE, RTCA, ISO, ASTM, ASD-STAN, …

→ component, subcategories, industrial level

Assessment of standards - categorization & evaluation

→ maturity, safety, cost, suitability …

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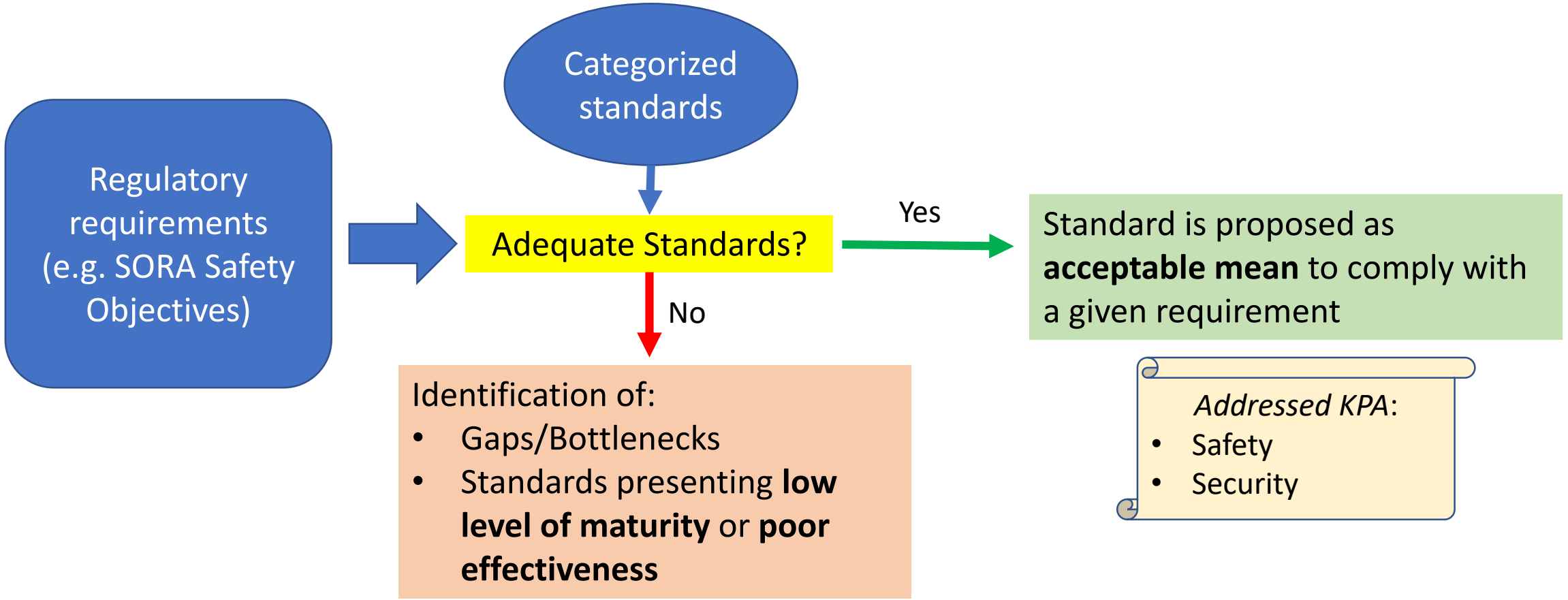
Methodology - Developing a “meta” standard



This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Scope

- Year 1: Standards required to support effectively the Specific Operations Risk Assessment (**SORA**) methodology
- Year 2: Standards supporting the development of **U-Space** in Europe
- Year 3: Standards needed to support the operation of **highly automated UAS** and to ensure that they can be operated safely in a variety of applications

Iterative approach throughout the project duration

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Stakeholders

- European Commission (DG-MOVE, INEA)
- EASA
- CAA Representatives
- Standard Making Bodies Representatives
  - EUROCAE, RTCA, ISO, ASTM, ASD-STAN, …
- UAS Manufacturers
- UAS Operators
- UTM Service Providers
- Research and Academia
- … do not feel left out!

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Stakeholders involvement

1. As source of information for data collection

Collection of drone standards

→ **airworthiness**, operations & procedures, ….

EUSCG RDP
ANSI Roadmap

Collection of drone-related and applicable general standards

EUROCAE, RTCA, ISO, ASTM, ASD-STAN, …

→ component, subcategories, industrial level

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Stakeholders involvement

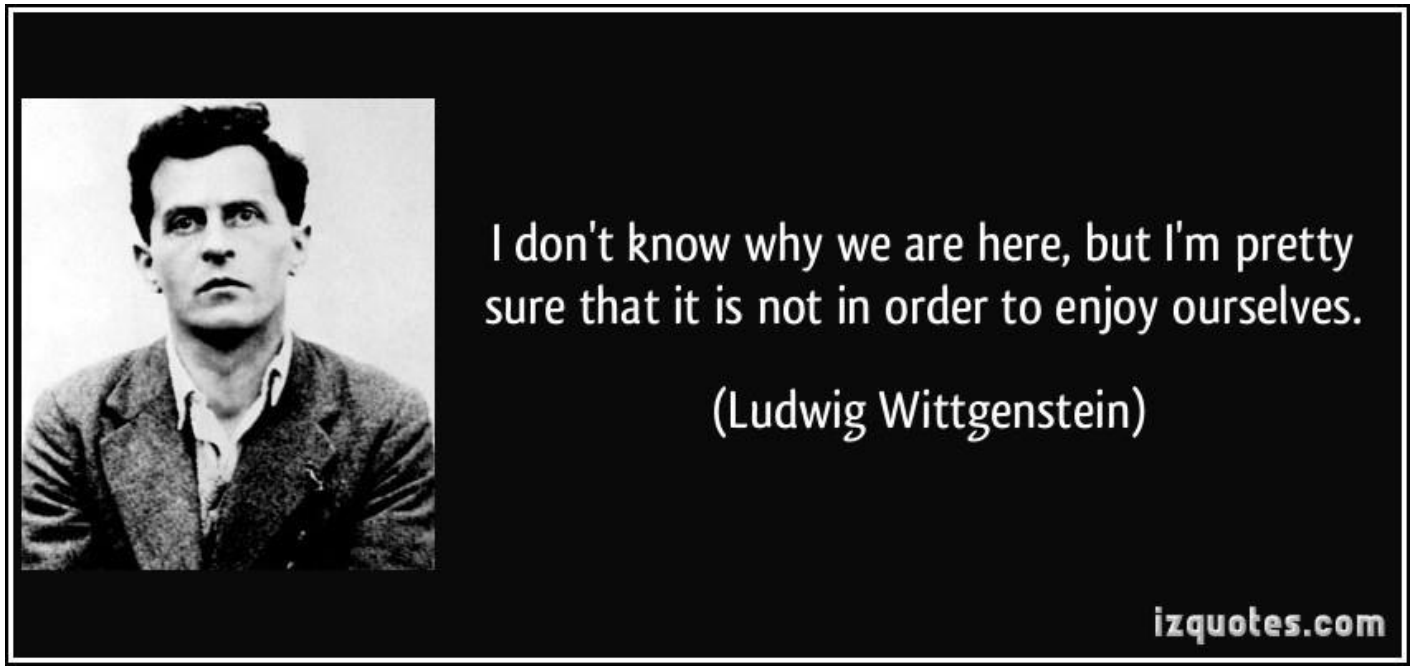
2. As source of feedback about methodology, standards assessment, correctness and completeness of information, etc.

By means of **workshops**, online surveys, ad-hoc round-tables, interactions on the social-media, etc.

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Stakeholders involvement

2. As source of feedback about methodology, standards assessment, correctness and completeness of information, etc.



This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

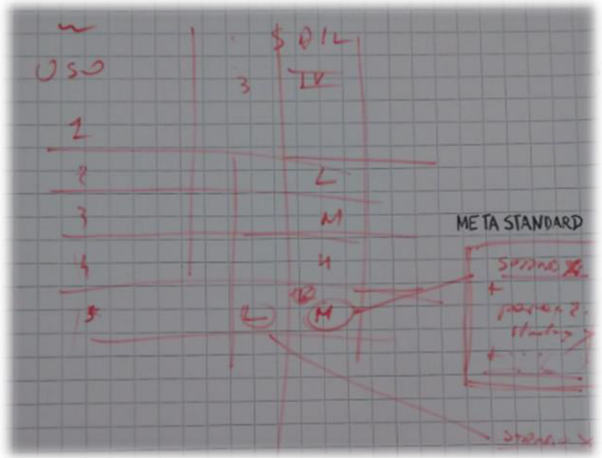
Stakeholders involvement

- Additional External experts will be able to contribute through:
  - Online surveys
  - Public Workshops
    - **Workshop 1 (today)**: Overview of the collected set of standards to support effectively the Specific Operations Risk Assessment (SORA) methodology
    - **Workshop 2 (June 2020)**: Overview of the collected set of standards to support U-Space implementation
    - **Workshop 3 (June-July 2021)**: Overview of the collected set of standards/principles for Autonomous UAS certification

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

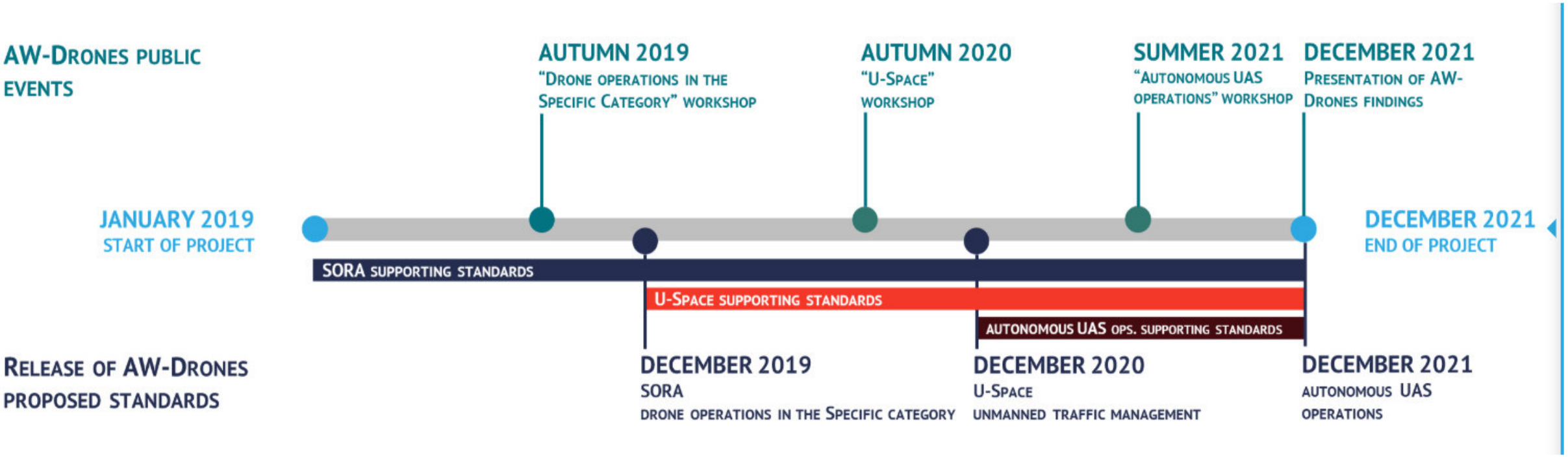
“Special” stakeholders

- AW-Drones has a dedicated link with the EC and EASA:
  - Mutual awareness about activities of common interest
  - Shared timeline following the regulatory roadmap
  - One collaborative workshop already took place last June in Cologne, others will follow shortly



This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Project timeline



This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

What we produce

- A **yearly report** about “State-of-the-Art” of standards for UAS
- A yearly report containing a **“well-reasoned” set of standards:**
  - Applicability
  - Maturity
  - KPA Effectiveness
- An **open repository** containing structured information about technical rules, procedures and standards for drones worldwide, including applicability to different UAS OPS categories and different SAIL = **metastandard**

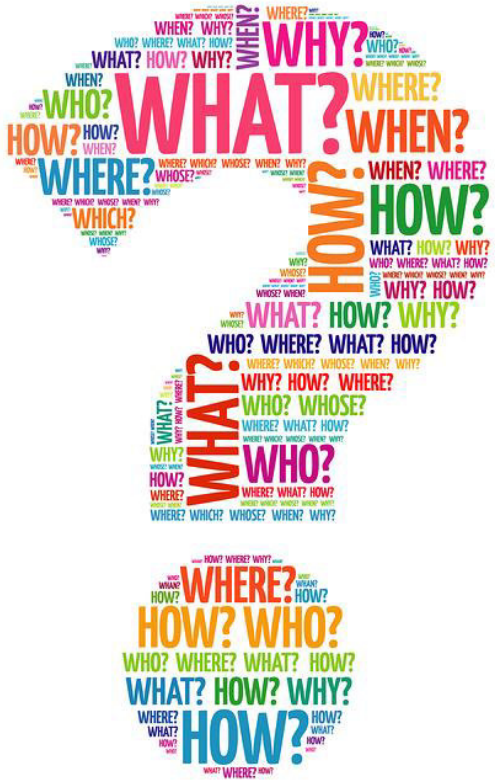
This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

What we do not produce

- AW-Drones does not draft UAS regulation
- AW-Drones does not produce UAS standards
- AW-Drones does not assess the technical quality of UAS standards

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Questions?



This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Follow us!

http://www.aw-drones.eu/

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Thank you for the attention

Project Coordinator:
damiano.taurino@dblue.it

Dissemination Manager:

vera.ferraiuolo@dblue.it

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

EASA
European Union Aviation Safety Agency

AW-Drone project

Status on drone regulation

Drone project team
19 September 2019

Your safety is our mission.

An Agency of the European Union

Performance-based, risk-based & operation centric regulation

Performance-based, risk-based & operation centric regulation

CE marking

NO-PRE APPROVAL

LIMITATIONS: 25 kg, Visual Line of Sight (VLOS), height <120m, system of zones

3 Sub-categories: fly over, close, far from people

General public / recreational purpose

Model Flying, Photographers

SPECIFIC - Increased risk

Authorisation by NAA based on specific operation risk assessment (SORA)

Declaration in case of standard scenario; LUC

BVLOS operations (linear inspections, aerial work, ...)

Transport of goods

NPA planned for Q3 2020

operator and licensed pilot (unless autonomous flight)

[by the NAAs]

Air Taxi

International IFR (cargo, passengers)

Package delivery over people

Specific category – Risk assessment

SORA

(Specific Operation Risk Assessment)

- Overflown area
- Airspace
- Operational safety objectives
- Remote pilot competency
- Mitigations

Safe and secure flight

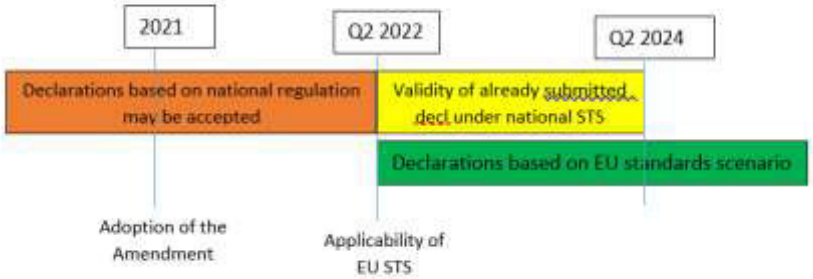
- Flight conditions
- Operational limitations,
- Remote pilot and other personnel competencies
- Technical requirements of the UAS
- Security and privacy

AMC and GM for open and specific category

- By September 2019 publish an EASA Decision including:
  - Revise AMC/GM published with the Opinion 01/2018 (and consulted through NPA 2017-05) to check consistency with latest versions of the IA/DA
  - Create new GM to include the result of the discussions held during last EASA committee
  - Publish the JARUS Specific Operation Risk Assessment (SORA) as AMC to Article 11 after adaptation of the document to EASA language
  - Publish the first predefined risk assessment discussed at the workshop in July 2018 and reviewed by JARUS WG6 as AMC to the specific category
- In 2020 publish an additional EASA Decision including :
  - Standards recognized as AMC for SORA Operational safety objectives (OSOs) and mitigations

Opinion on standard scenarios (STS)

- STSs based on declarations and will be Appendices to the IA
- 2 STS (based on scenarios already used in some MS)
  - VLOS, Below 120m in urban environment, with UA MTOM<25kg
  - BVLOS (using visual observer), Below 120m in sparsely populated area environment, range <2km, with UA MTOM<25kg
- Compliance with technical requirements ensured through CE mark
- Applicability:

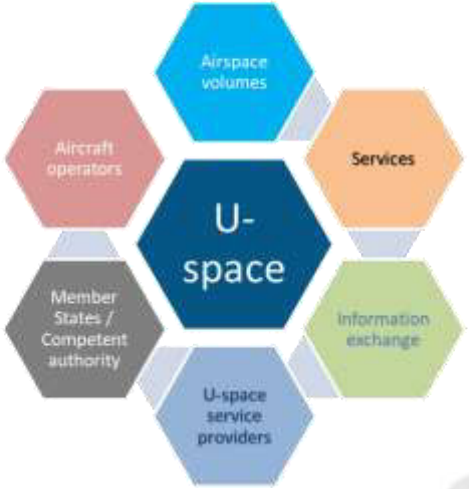


Publication of EASA Opinion expected by Q4 2019
Adoption of amendment expected by end of 2020

U-space

- Airspace volume designated by the MS where U-space services are provided.
- Essential services:
  - E-identification
  - Geo-awareness
  - Traffic information
- Consultation with Advisory Bodies 1-23 October
- EASA's Opinion by end of 2019

Building blocks



EASA

NPA#1 certified category: three types of operations

Operations type #1: IFR operations of certified UAS cargo flying in airspace classes A-C and taking-off and landing at aerodromes under EASA's scope

Operations type #2: UAS 0perations in urban environment using pre-defined routes in volume of airspaces where U-space services are provided. This includes operations of UAS VTOL type carrying passengers (i.e. air taxis) and small UAS cargo providing delivery services.

Operations type #3: Operations as in type#2 conducted with Manned VTOL.

NPA#1 certified category planning

- EASA is developing a concept paper that may be published by the end of 2019
- NPA planned to be published in Q3 2020
- Opinion planned to be published in Q3 2021

EASA
European Union Aviation Safety Agency

Questions?

Check for more details

AW DRONES

First Information Dissemination Workshop
EUROCONTROL Headquarters - Brussels, Belgium
September 19, 2019

PARTICIPANTS

Photo: Antonia Vadalá - EUROCONTROL - Communications and Stakeholder Relations

AW DRONES

Drone standards state-of-the-art - Data collection and classification framework

Sebastian Cain

German Aerospace Center - DLR

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

- What we want to do…
- Approach
- Data Sources
- Structuring
  - Domains
  - Mapping to Requirements from the SORA
- Status of the work and way forward

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What we want to do…

Data collection and analysis 1st step

Gather standards applicable to mass market drones which are

already in use or in development

and develop a structured overview document

Support EASA and EC in the progress of a drone regulatory framework by

providing an overview of available support of regulation

show documents & standards that support current approach proposed by SORA and allow conclusions on gaps

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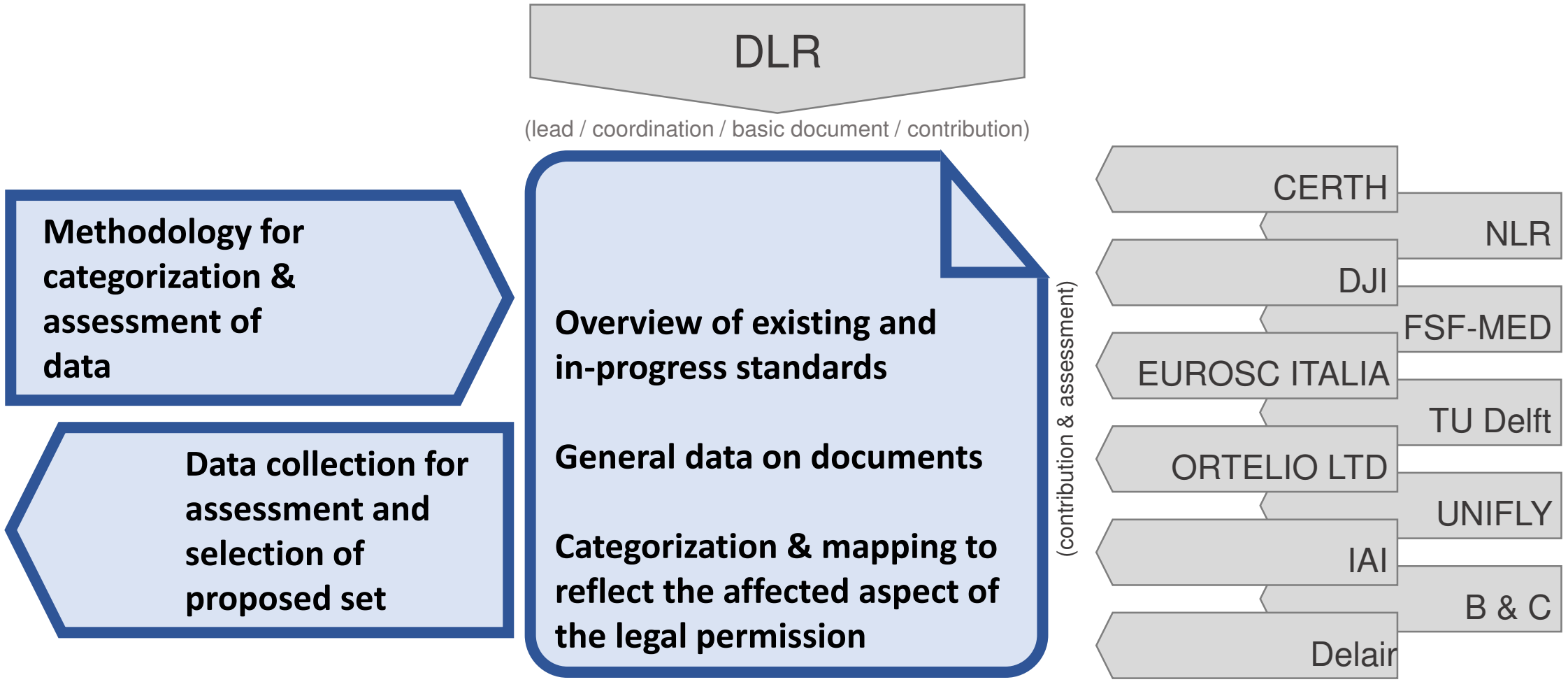
Structure of Approach



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Data Sources

Data Collection of Drone (-related) Standards

Standards Data

- ☑ EUSCG Rolling development plan
- ☑ ANSI Standardization Roadmap for Unmanned Aircraft Sytems
- ☑ ASTM UAS Roadmap
- Collection of other applicable standards (ASTM, ISO, DIN, RTCA, SAE, …)

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Structuring of Data

Data Collection of Drone (-related) Standards

General Data

Domain
Topic | Subtopic

Document Data
Type | N° | Title | Organization | Status | Description

Drone Category
Open | Spec | Cert

Mapping to SORA requirements

Standards Data

- EUSCG Rolling development plan
- ANSI Standardization Roadmap for Unmanned Aircraft Systems
- ASTM UAS Roadmap
- Collection of other applicable standards (ASTM, ISO, DIN, RTCA, SAE, …)

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Categorization to Domains

General	Design & Airworthiness (at product level)		Avionics & Equipment	Personnel	U-Space	Operations		Oversight
Definitions	Manufacturer organization (design & production)	Maintenance	General	Remote Pilot Competence	General	General	Marking and Registration	Notified bodies and Qualified Entities
Classfication of UAS Operations	Design	Management of Continuous Airworthiness	Communication	UAS Maintenance personnel competence	E-Identification	Security (operator's responsibility)	Level of Automation/ Autonomy	
Manuals	Production	Electromagnetic Compatibility and Lightning Protection	Detect and Avoid	Additional crew members competence	Service Providers	Operator organization	RPS Service Provider	
Classification of Drones	Systems safety assessement	Software Development & Assurance	Navigation	Human Factors	Tracking	C2 Link Service Provider	Take-off/Landing zones (Urban Vertiports)	
	Electrical System	Emergency capabilities & Health monitoring	Lights	Instructors	Geo-awareness	Standard Scenarios	Ground Handling Service	
	Propulsion systems	Structures	Cyber-security	Examiners		UAS-ATM (IFR above VLL and below FL 600)	Accident/Incident investigation	
	Fuel	Flight Handling	Instruments	Assessors		Risk Assessment (Operations)		
	Noise & Environment	Perfomance	Traffic surveillance (tracking)	Training Organizations				
	Level of Automation/ Autonomy	Ground Control Station	Command and Control (C2) Link					
	Flight Control System							

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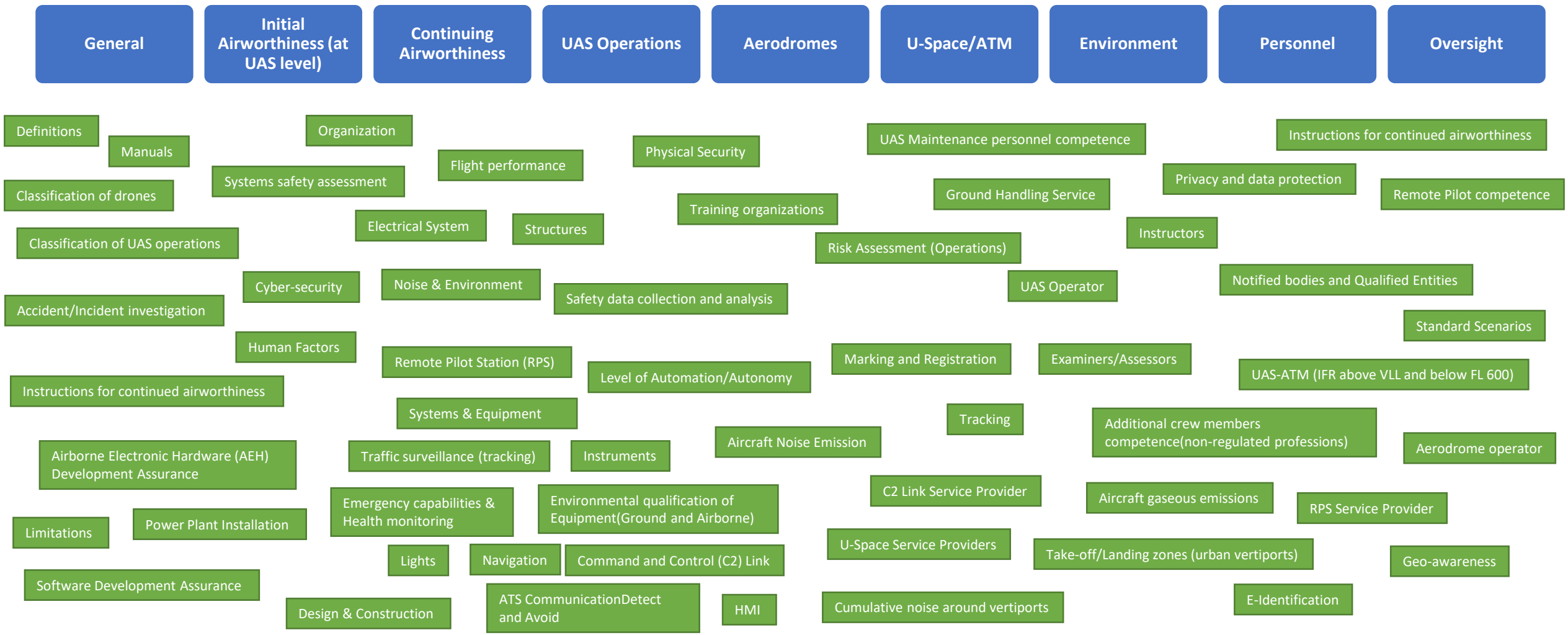
Categorization to Domains - Revised



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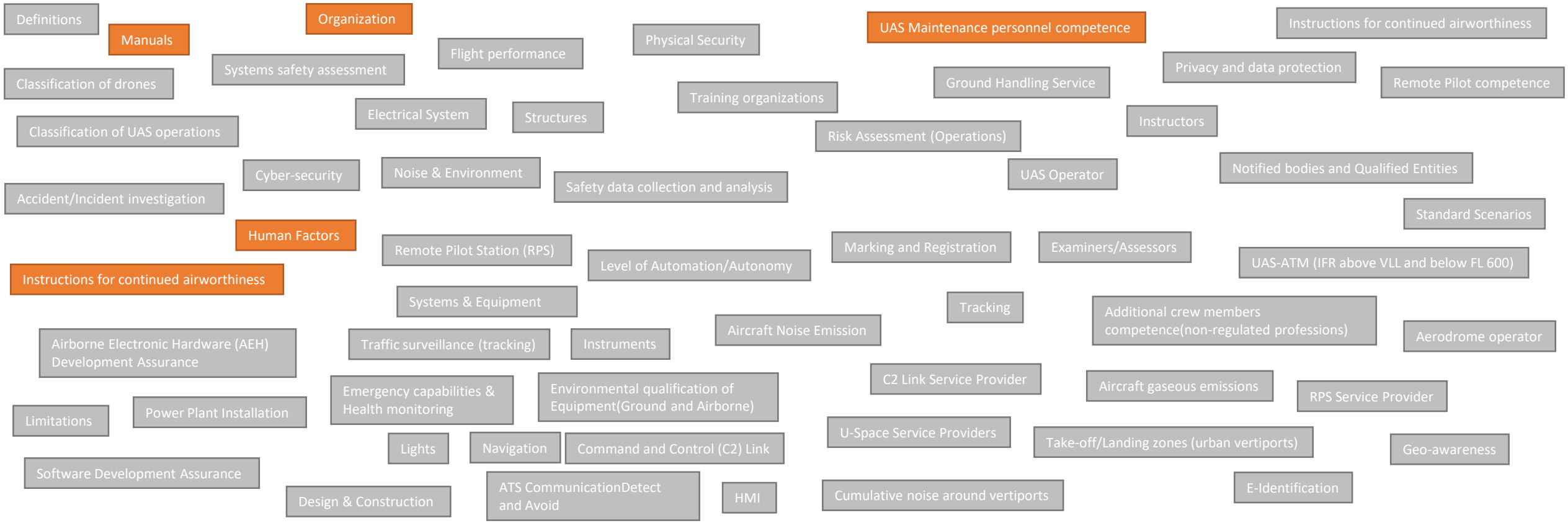
Categorization to Domains - Revised

General	Initial Airworthiness (at UAS level)	Continuing Airworthiness	UAS Operations	Aerodromes	U-Space/ATM	Environment	Personnel	Oversight



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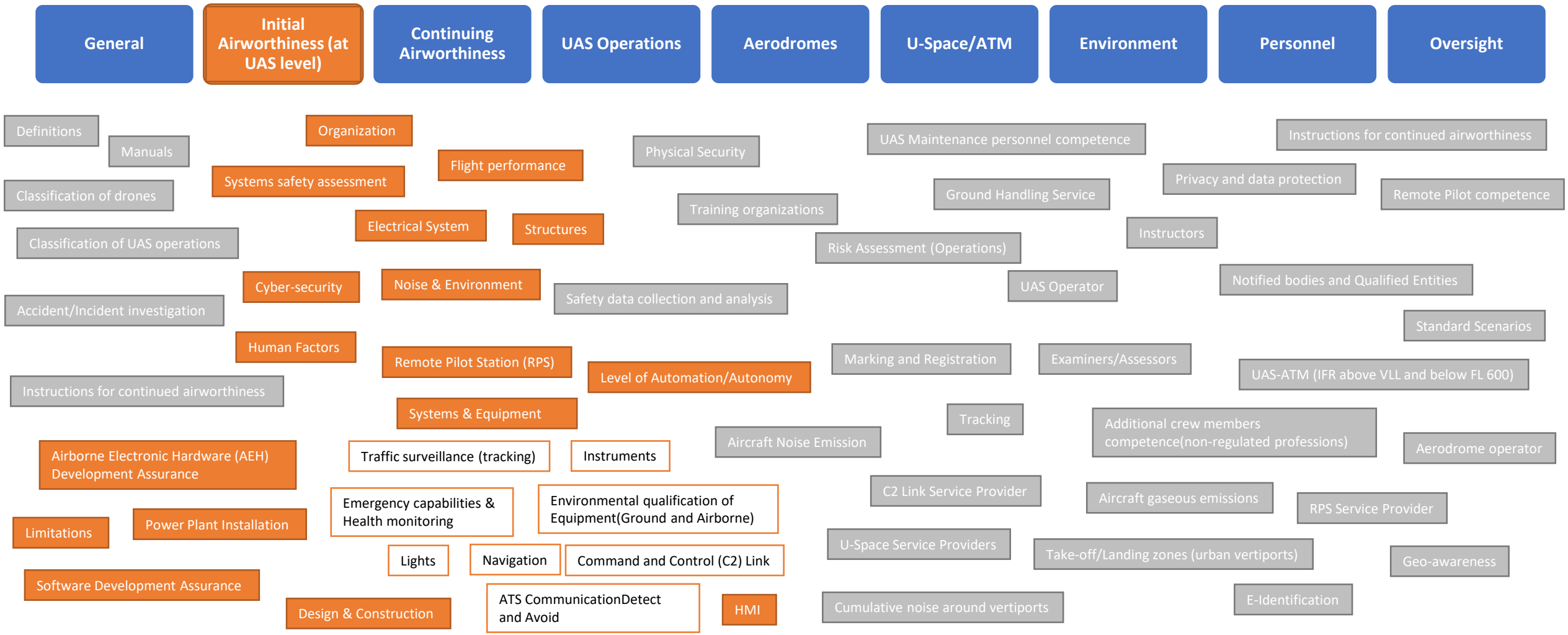
Categorization to Domains - Revised



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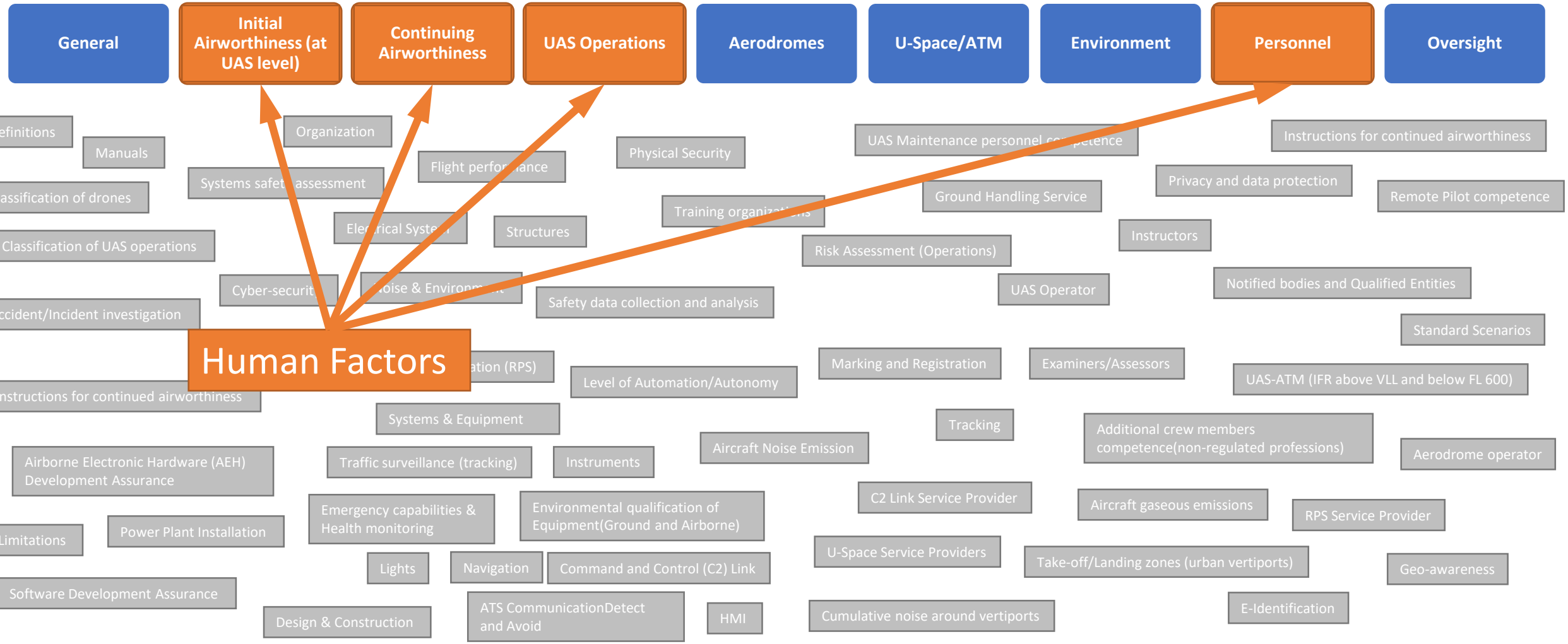
Categorization to Domains - Revised



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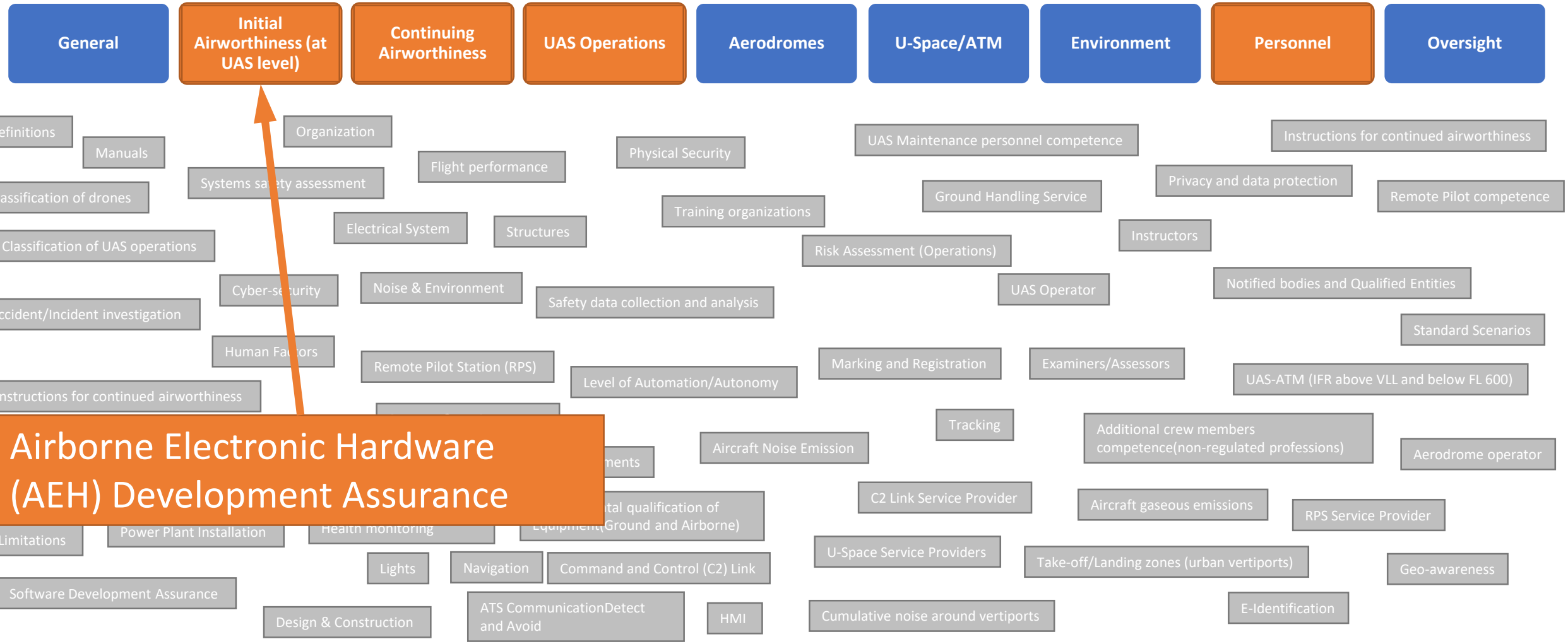
Categorization to Domains - Revised



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Structuring of Data

Data collection of drone (-related) standards

General Data

Domain
Topic | Subtopic

Document Data
Type | N° | Title | …

Drone Category
Open | Spec | Cert

Mapping to SORA requirements

Standards Data

- EUSCG Rolling development plan
- ANSI Standardization Roadmap for Unmanned Aircraft Systems
- ASTM UAS Roadmap
- Collection of other applicable standards (ASTM, ISO, DIN, RTCA, SAE, …)

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Structuring of Data

Data collection of drone (-related) standards

General Data		Drone Category	Categorization			
Domain Topic | Subtopic	**Document Data** Type | N° | Title | …	Open | Spec | Cert	**Affected OSOs** #01 … #24	**Affected GRM** M1 [1…2]| M2 | ERP	**Affected ARM** Strat | Tact	**SORA STEP #9**
Standards Data			X X X X	X X X X X X X X X	X X X X	X X

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Data Collection Document

69 / 612	Domain		Type			Document					UAS Category		
N°	Domain	Subtopic	Standard/Specification	Best Practices	Information/Guidance	Document N°	Title	Organization	Status	Description	open	specific	certified
5	General	Classification of drones	X			ISO 21895	Requirements for the categorization and classification of civil UAS	ISO TC20 / SC16 / WG1	ongoing	Requirements for the categorization and classification of civil UAS. The standard	X	X	X
6	General	Definitions	X			ISO 21384-1	General requirements for UAS for civil and commercial applications, UAS terminology and classification	ISO TC20 / SC16 / WG1	ongoing	Provides the foundation and common terms, definitions and references relevant to the	X	X	X
7	General	Manuals	X			ASTM WK62744	New Practice for General Operations Manual for Professional Operator of Light Unmanned Aircraft Systems (UAS)	ASTM F38 Unmanned Aircraft Systems	onging	This standard defines the requirements for General Operations Manual for	X	X	X
20	Avionics & Equipment	Command and Control (C2) Link	X				MOPS (Terrestrial LOS)	EUROCAE WG-105	ongoing	Minimum Operational Performance Standard for the terrestrial Line of Sight	X	X	X
21	Avionics & Equipment	Command and Control (C2) Link	X				MOPS (SATCOM)	EUROCAE WG-105	ongoing	Minimum Operational Performance Standard for the satellite Command and Control	X	X	X
22	Avionics & Equipment	Command and Control (C2) Link	X				Minimum Aviation System Performance Standard for the Command and Control Link	EUROCAE WG-105	ongoing		X	X	X
51	Avionics & Equipment	Detect & Avoid	X				Minimum Aviation System Performance Standard (End-to-end Requirements at system level) for DAA of IFR Flights in class A-C airspace.	EUROCAE WG-105	ongoing		X	X	X
52	Avionics & Equipment	Detect & Avoid	X				Minimum Operational Performance Standard (Requirements at equipment level) for DAA of IFR Flights in class A-C airspace.	EUROCAE WG-105	ongoing			X	X
53	Avionics & Equipment	Detect & Avoid	X				Operational Services and Environment Description for DAA for DAA in Class D-G airspaces under VFR/IFR	EUROCAE WG-105	ongoing		X	X	X
54	Avionics & Equipment	Detect & Avoid	X				Minimum Aviation System Performance Standard (End-to-end Requirements at system level) for DAA against conflicting traffic for RPAS operating	EUROCAE WG-105	ongoing			X	X
55	Avionics & Equipment	Detect & Avoid	X				Minimum Operational Performance Standard (Requirements at equipment level) for DAA against conflicting traffic for RPAS operating	EUROCAE WG-105	planned			X	X
56	Avionics & Equipment	Detect & Avoid	X				OperationalServices and Environmental Description for DAA in very Low Level Operations	EUROCAE WG-105	ongoing		X	X	X
57	Avionics & Equipment	Detect & Avoid	X				Minimum Operational Performance Standard (Requirements at equipment level) for DAA at Very Low Level (VLL)	EUROCAE WG-105	planned		X	X	X
58	Avionics & Equipment	Detect & Avoid			X	STANREC 4811 Ed. 1/ AEP-. 101 Ed. A Ver.1	UAS sense and avoid	NATO FINAS	published	To detail comprehensive guidance and recommended practice for the development of	X	X	X
63	Design & Airworthiness	Level of Automation/Autonomy	X			ED-252 OSED		EUROCAE WG-105	published	Operational Services and Enironment Description for Automatic Take-Off and Landing.	X	X	X
64	Design & Airworthiness	Level of Automation/Autonomy	X			MASPS	Minimum Aviation System Performance Standard (End-to-end Requirements at system level) for Automatic Take-Off and Landing	EUROCAE WG-105	planned		X	X	X
65	Design & Airworthiness	Level of Automation/Autonomy	X			ED-251 OSED		EUROCAE WG-105	published	Operational Services and Enironment Description for Automatic Taxiing	X	X	X
66	Design & Airworthiness	Level of Automation/Autonomy	X			MASPS	Minimum Aviation System Performance Standard (End-to-end Requirements at system level) for Automatic Taxiing	EUROCAE WG-105	planned		X	X	X
67	Design & Airworthiness	Emergency capabilities	X			OSED		EUROCAE WG-105	ongoing	Operational Services and Enironment Description for Automation and Emergency	X	X	X
68	Design & Airworthiness	Emergency capabilities	X			MASPS	Minimum Aviation System Performance Standard (End-to-end Requirements at system level) for automation and Emergency Recovery	EUROCAE WG-105	planned		X	X	X
97	Design & Airworthiness	Emergency capabilities	X			ASTM WK59171	New Specification for SUAS parachutes	ASTM F38 Unmanned Aircraft Systems	ongoing	Develop a draft standard that defines the requirements for a parachute system that would	X	X	X
98	Design & Airworthiness	Emergency capabilities	X			F3322-18	Standard Specification for Small Unmanned Aircraft System (sUAS) Parachutes	ASTM F38 Unmanned Aircraft Systems	Published	This specification covers the design and manufacture requirements for deployable	X	X	X
99	Design & Airworthiness	Electrical System	X			F2490-05(2013)	Standard Guide for Aircraft Electrical Load and Power Source Capacity Analysis	ASTM F39 Aircraft Systems	published	This guide covers how to prepare an electrical load analysis (ELA) to meet Federal		X	X
100	Design & Airworthiness	Management of Continuos Airworthiness	X			F2799-14	Standard Practice for Maintenance of Aircraft Electrical Wiring Systems	ASTM F39 Aircraft Systems	published	Damaged wiring or equipment in an aircraft, regardless of how minor it may appear to be		X	X

	Affected SORA OSO: Technical							Operational				Remote crew training			Safe design		Deterioration of	Human Error					Adverse Operating Conditions	
N°	#01	#02	#03	#04	#05	#06	#07	#08	#11	#14	#21	#09	#15	#22	#10	#12	#13	#16	#17	#18	#19	#20	#23	#24
5																								
6																								
7	X						X	X	X	X	X							X	X		X		X	
20				X	X	X									X	X								
21				X	X	X									X	X								
22				X	X	X									X	X								
51				X	X																			
52				X	X																			
53				X	X																			
54				X	X																			
55				X	X																			
56				X	X			X			X												X	
57				X	X			X			X												X	
58	X		X	X	X	X		X		X	X	X										X		
63				X				X	X	X	X													
64				X				X	X	X	X													
65				X				X	X	X														
66				X				X	X	X														
67				X				X	X	X	X				X	X					X			
68				X				X	X	X	X				X	X					X			
97																								
98					x										x	x								
99				x											x	x								
100			x																					

	Ground Risk Mitigations: M1 (Generic) Strategic M.		Tethered operation		M2 (Effects of ground impact)			ERP	Collision Risk (Air Risk): Strategic Mitigation: Operational Restrictions			Common Structures and Rules		Tactical Mitigation: VLOS	BVLOS					SORA Step #9				
N°	M1 S#1	M1 S#2	M1 T#1	M1 T#2	M2 #1	M2 #2	M2 #3	M3 #1	Boundary	Chronology	Time of Exposure	Common Flight Rules	Common Airspace Structure	VLOS	Detect	Decide	Command	Execute	Feedback loop	Containment	Comments	Access	Responsible	Assessed
5																					No clear mapping found		EuroUSC	X
6																					No clear mapping found		EuroUSC	X
7																					A draft is not available. A preliminary mapping is performed.		EuroUSC	X
20																	X		X		OSO #4 "This should be a standard similar to the MOPS for SATCOM with		EuroUSC	X
21																	X		X		OSO #4 "Since the C2 Link is part of the UAS, then this standard provides a		EuroUSC	X
22																	X		X	X	MASPS define requirements at system (sub-system) and not at		EuroUSC	X
51															X	X	X		X		Tactical Miitgation: Detect The DAA functionalities include		EuroUSC	X
52															X	X	X		X		TThe draft is still not available. Preliminary mapping is made taking		EuroUSC	X
53															X	X	X		X		he OSED only defines high level requirements and enviromental		EuroUSC	X
54															X	X	X		X		The draft is still not available. Preliminary mapping is made taking		EuroUSC	X
55															X	X	X		X		The draft is still not available. Preliminary mapping is made taking		EuroUSC	X
56															X	X	X		X		Tactical Mitigation:Detect : The DAA functionalities		EuroUSC	X
57															X	X	X		X		A draft is not availabe at the moment. Preliminary mapping is made		EuroUSC	X
58												X			X	X			X		Standard: "UAV emergency procedures should mirror those for		TUDelft	X
63													X								OSO #4:ATOL capability can be included as a core standard for certain UASs		EuroUSC	X
64													X								Draft not available yet. A preliminary mapping is made considering what is		EuroUSC	X
65																					OSO #4: Automatic taxing capability can be included as a core		EuroUSC	X
66																					No draft published. Preliminary mapping derived from the OSED.		EuroUSC	X
67																				X	OSO #4 Emergency & Recovery functions can be included in the UAS		EuroUSC	X
68																				X	A draft is not available yet. A preliminary mapping is made		EuroUSC	X
97																				x	with current hypothesis, assumed to be identical to other ASTM parachute	controlled	DELAIR	x
98					x															x	OPEN: potentialy to meet 80J threshold, but not	controlled	DELAIR	x
99																					OPEN: Electrical stds Not	controlled	DELAIR	x
100																					OPEN: Electrical stds Not mentioned in ASD-STAN	controlled	DELAIR	x

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Data Collection Document

General Data	Category	Mapping to SORA	Editorial

69 / 612	Domain		Type			Document					UAS Category		
N°	Domain	Subtopic	Standard/Specification	Best Practices	Information/Guidance	Document N°	Title	Organization	Status	Description	open	specific	certified
5	General	Classification of drones	X			ISO 21895	Requirements for the categorization and classification of civil UAS	ISO TC20 / SC16 / WG1	ongoing	Requirements for the categorization and classification of civil UAS. The standard	X	X	X
6	General	Definitions	X			ISO 21384-1	General requirements for UAS for civil and commercial applications, UAS terminology and classification	ISO TC20 / SC16 / WG1	ongoing	Provides the foundation and common terms, definitions and references relevant to the	X	X	X
7	General	Manuals	X			ASTM WK62744	New Practice for General Operations Manual for Professional Operator of Light Unmanned Aircraft Systems (UAS)	ASTM F38 Unmanned Aircraft Systems	onging	This standard defines the requirements for General Operations Manual for	X	X	X
20	Avionics & Equipment	Command and Control (C2) Link	X				MOPS (Terrestrial LOS)	EUROCAE WG-105	ongoing	Minimum Operational Performance Standard for the terrestrial Line of Sight	X	X	X
21	Avionics & Equipment	Command and Control (C2) Link	X				MOPS (SATCOM)	EUROCAE WG-105	ongoing	Minimum Operational Performance Standard for the satellite Command and Control	X	X	X
22	Avionics & Equipment	Command and Control (C2) Link	X				Minimum Aviation System Performance Standard for the Command and Control Link	EUROCAE WG-105	ongoing		X	X	X
51	Avionics & Equipment	Detect & Avoid	X				Minimum Aviation System Performance Standard (End-to-end Requirements at system level) for DAA of IFR Flights in class A-C airspace.	EUROCAE WG-105	ongoing		X	X	X
52	Avionics & Equipment	Detect & Avoid	X				Minimum Operational Performance Standard (Requirements at equipment level) for DAA of IFR Flights in class A-C airspace.	EUROCAE WG-105	ongoing			X	X
53	Avionics & Equipment	Detect & Avoid	X				Operational Services and Environment Description for DAA for DAA in Class D-G airspaces under VFR/IFR	EUROCAE WG-105	ongoing		X	X	X
54	Avionics & Equipment	Detect & Avoid	X				Minimum Aviation System Performance Standard (End-to-end Requirements at system level) for DAA against conflicting traffic for RPAS operating	EUROCAE WG-105	ongoing			X	X
55	Avionics & Equipment	Detect & Avoid	X				Minimum Operational Performance Standard (Requirements at equipment level) for DAA against conflicting traffic for RPAS operating	EUROCAE WG-105	planned			X	X
56	Avionics & Equipment	Detect & Avoid	X				OperationalServices and Environmental Description for DAA in very Low Level Operations	EUROCAE WG-105	ongoing		X	X	X
57	Avionics & Equipment	Detect & Avoid	X				Minimum Operational Performance Standard (Requirements at equipment level) for DAA at Very Low Level (VLL)	EUROCAE WG-105	planned		X	X	X
58	Avionics & Equipment	Detect & Avoid			X	STANREC 4811 Ed. 1/ AEP-. 101 Ed. A Ver.1	UAS sense and avoid	NATO FINAS	published	To detail comprehensive guidance and recommended practice for the development of	X	X	X
63	Design & Airworthiness	Level of Automation/Autonomy	X			ED-252 OSED		EUROCAE WG-105	published	Operational Services and Enironment Description for Automatic Take-Off and Landing.	X	X	X
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65	Design & Airworthiness	Level of Automation/Autonomy	X			ED-251 OSED		EUROCAE WG-105	published	Operational Services and Enironment Description for Automatic Taxiing	X	X	X
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67	Design & Airworthiness	Emergency capabilities	X			OSED		EUROCAE WG-105	ongoing	Operational Services and Enironment Description for Automation and Emergency	X	X	X
68	Design & Airworthiness	Emergency capabilities	X			MASPS	Minimum Aviation System Performance Standard (End-to-end Requirements at system level) for automation and Emergency Recovery	EUROCAE WG-105	planned		X	X	X
97	Design & Airworthiness	Emergency capabilities	X			ASTM WK59171	New Specification for SUAS parachutes	ASTM F38 Unmanned Aircraft Systems	ongoing	Develop a draft standard that defines the requirements for a parachute system that would	X	X	X
98	Design & Airworthiness	Emergency capabilities	X			F3322-18	Standard Specification for Small Unmanned Aircraft System (sUAS) Parachutes	ASTM F38 Unmanned Aircraft Systems	Published	This specification covers the design and manufacture requirements for deployable	X	X	X
99	Design & Airworthiness	Electrical System	X			F2490-05(2013)	Standard Guide for Aircraft Electrical Load and Power Source Capacity Analysis	ASTM F39 Aircraft Systems	published	This guide covers how to prepare an electrical load analysis (ELA) to meet Federal		X	X
100	Design & Airworthiness	Management of Continuos Airworthiness	X			F2799-14	Standard Practice for Maintenance of Aircraft Electrical Wiring Systems	ASTM F39 Aircraft Systems	published	Damaged wiring or equipment in an aircraft, regardless of how minor it may appear to be		X	X

	Affected SORA OSO																							
	Technical							Operational				Remote crew training			Safe design		Deterioration of external	Human Error					Adverse Operating Conditions	
N°	#01	#02	#03	#04	#05	#06	#07	#08	#11	#14	#21	#09	#15	#22	#10	#12	#13	#16	#17	#18	#19	#20	#23	#24
5																								
6																								
7	X						X	X	X	X	X							X	X		X		X	
20				X	X	X									X	X								
21				X	X	X									X	X								
22				X	X	X									X	X								
51				X	X																			
52				X	X																			
53				X	X																			
54				X	X																			
55				X	X																			
56				X	X			X			X												X	
57				X	X			X			X												X	
58	X		X	X	X	X		X		X	X	X										X		
63				X				X	X	X	X													
64				X				X	X	X	X													
65				X				X	X	X														
66				X				X	X	X														
67				X				X	X	X	X				X	X					X			
68				X				X	X	X	X				X	X					X			
97																								
98					x										x	x								
99				x											x	x								
100			x																					

	Ground Risk Mitigations								Collision Risk (Air Risk)											SORA Step #9				
	M1 (Generic)				M2 (Effects of ground impact)			ERP	Strategic Mitigation					Tactical Mitigation										
	Strategic M.		Tethered operation						Operational Restrictions			Common Structures and Rules		VLOS	BVLOS									
N°	M1 S#1	M1 S#2	M1 T#1	M1 T#2	M2 #1	M2 #2	M2 #3	M3 #1	Boundary	Chronology	Time of Exposure	Common Flight Rules	Common Airspace Structure	VLOS	Detect	Decide	Command	Execute	Feedback loop	Containment	Comments	Access	Responsible	Assessed
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6																					No clear mapping found		EuroUSC	X
7																					A draft is not available. A preliminary mapping is performed.		EuroUSC	X
20																	X		X		OSO #4 "This should be a standard similar to the MOPS for SATCOM with		EuroUSC	X
21																	X		X		OSO #4 "Since the C2 Link is part of the UAS, then this standard provides a		EuroUSC	X
22																	X		X	X	MASPS define requirements at system (sub-system) and not at		EuroUSC	X
51															X	X	X		X		Tactical Miitgation: Detect The DAA functionalities include		EuroUSC	X
52															X	X	X		X		TThe draft is still not available. Preliminary mapping is made taking		EuroUSC	X
53															X	X	X		X		he OSED only defines high level requirements and enviromental		EuroUSC	X
54															X	X	X		X		The draft is still not available. Preliminary mapping is made taking		EuroUSC	X
55															X	X	X		X		The draft is still not available. Preliminary mapping is made taking		EuroUSC	X
56															X	X	X		X		Tactical Mitigation:Detect : The DAA functionalities		EuroUSC	X
57															X	X	X		X		A draft is not availabe at the moment. Preliminary mapping is made		EuroUSC	X
58												X			X	X			X		Standard: "UAV emergency procedures should mirror those for		TUDelft	X
63													X								OSO #4:ATOL capability can be included as a core standard for certain UASs		EuroUSC	X
64													X								Draft not available yet. A preliminary mapping is made considering what is		EuroUSC	X
65																					OSO #4: Automatic taxing capability can be included as a core		EuroUSC	X
66																					No draft published. Preliminary mapping derived from the OSED.		EuroUSC	X
67																				X	OSO #4 Emergency & Recovery functions can be included in the UAS		EuroUSC	X
68																				X	A draft is not available yet. A preliminary mapping is made		EuroUSC	X
97																				x	with current hypothesis, assumed to be identical to other ASTM parachute	controlled	DELAIR	x
98					x															x	OPEN: potentialy to meet 80J threshold, but not	controlled	DELAIR	x
99																					OPEN: Electrical stds Not	controlled	DELAIR	x
100																					OPEN: Electrical stds Not mentioned in ASD-STAN	controlled	DELAIR	x

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Data Collection Document – Example

General Data		Category	Mapping to SORA	Editorial
F3330 - 18	Standard Specification for Training and the Development of Training Manuals for the UAS Operator	ASTM	published	1.1 This specification defines the requirements for training and the development of training manuals for the unmanned aircraft systems (UAS) operator. …

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Data Collection Document – Example

General Data	Category	Mapping to SORA	Editorial

F3330 - 18	Standard Specification for Training and the Development of Training Manuals for the UAS Operator	ASTM

Domain	
Domain	Subtopic
Personnel	Remote Pilot competence

UAS Category		
open	specific	certified
	X	X

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Data Collection Document – Example

F3330 - 18	Standard Specification for Training and the Development of Training Manuals for the UAS Operator	ASTM

Affected SORA OSO																							
Technical							Operational				Remote crew training			Safe design		Deterioration of external systems supporting UAS operation	Human Error					Adverse Operating Conditions	
#01	#02	#03	#04	#05	#06	#07	#08	#11	#14	#21	#09	#15	#22	#10	#12	#13	#16	#17	#18	#19	#20	#23	#24
Ensure the operator is competent and/or proven	UAS manufactured by competent and/or proven entity	UAS maintained by competent and/or proven entity	UAS developed to authority recognized design standards	UAS is designed considering system safety and reliability	C3 link characteristics (e.g. performance, spectrum use) are appropriate for the operation	Inspection of the UAS (product inspection) to ensure consistency to the ConOps	Operational procedures are defined, validated and adhered to (to address technical issues with the UAS)	Procedures are in-place to handle the deterioration of external systems supporting UAS operation	Operational procedures are defined, validated and adhered to (to adress human errors)	Operational procedures are defined, validated and adhered to (to address Adverse Operating Conditions)	Remote crew trained and current and able to control the abnormal and emergency situations (i.e. Technical issue with the UAS)	Remote crew trained and current and able to control the abnormal and emergency situations (i.e. Human Error)	The remote crew is trained to identify critical environmental conditions and to avoid them	Safe recovery from technical issue	The UAS is designed to manage the deterioration of external systems supporting UAS operation	External services supporting UAS operations are adequate to the operation	Multi crew coordination	Remote crew is fit to operate	Automatic protection of the flight envelope from human errors	Safe recovery from Human Error	A Human Factors evaluation has been performed and the Human-Machine Interface (HMI) found appropriate for the mission	Environmental conditions for safe operations defined, measurable and adhered to	UAS designed and qualified for adverse environmental conditions (e.g. adequate sensors, DO-160 qualification)
						X					X	X	X				X			X		X	

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F3330 - 18	Standard Specification for Training and the Development of Training Manuals for the UAS Operator	ASTM

a Collection Document – Example

Ground Risk Mitigations								Collision Risk (Air Risk)												SORA Step #9
M1 (Generic)				M2 (Effects of ground impact)			ERP	Strategic Mitigation					Tactical Mitigation							
Strategic M.		Tethered operation						Operational Restrictions			Common Structures and Rules		VLOS	BVLOS						
M1 S#1	M1 S#2	M1 T#1	M1 T#2	M2 #1	M2 #2	M2 #3	M3 #1	Boundary	Chronology	Time of Exposure	Common Flight Rules	Common Airspace Structure	VLOS	Detect	Decide	Command	Execute	Feedback loop	Containment
Definition of the ground risk buffer	Evaluation of people at risk	Technical Desgin of tether	Procedures for tether installation & control	Technical Design for ground impact	Procedures for equipment installation	Training for ground impact measures	Emergency Response Plan	Mitigations that bound the geographical volume in which the UAS operates	Mitigations that bound the operational time frame	Mitigations that bound the time of exposure	Mitigations by setting a common set of rules which [illegible]	Mitigations by [illegible] airspace through, physical characteristics, procedures, and techniques	Tactical mitigation with the remaining well clear and avoiding collisions [illegible]	precision for the avoidance manoeuvre (ARC-a to ARC-d)	Define Decide with adequate precision for the avoidance manoeuvre (ARC-a to ARC-d)	precision for the avoidance manoeuvre (ARC-a to ARC-d)	precision for the avoidance manoeuvre (ARC-a to ARC-d)	adequate precision for the avoidance manoeuvre (ARC-a to ARC-d)	requirements for adjacent airspace and area considered
						X														

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Data Collection Document – Example

		ry	Mapping to SORA	Editorial
F3330 - 18	Standard Specification for Training and the Development of Training Manuals for the UAS Operator	ASTM		

Comments	Access	Responsible	Assessed
This specification defines the requirements for training and the development of training manuals for the unmanned aircraft systems (UAS) operator. The standard includes requirements or best practices, or both, for documentation and organization of a professional operator (that is, for compensation and hire) for the purposes of internal training programs. The standard may cover the development of a training syllabus that includes Multi Crew coordination	controlled	DBL	**X**

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Current Status

Status

Currently >600 documents in the table

~50% of documents mapped

Feedback from partners & EASA experts

Progress

Data collection

Data mapping to SORA

Adaption to new proposed Domain system

Data assessment (first step)

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Thank you!

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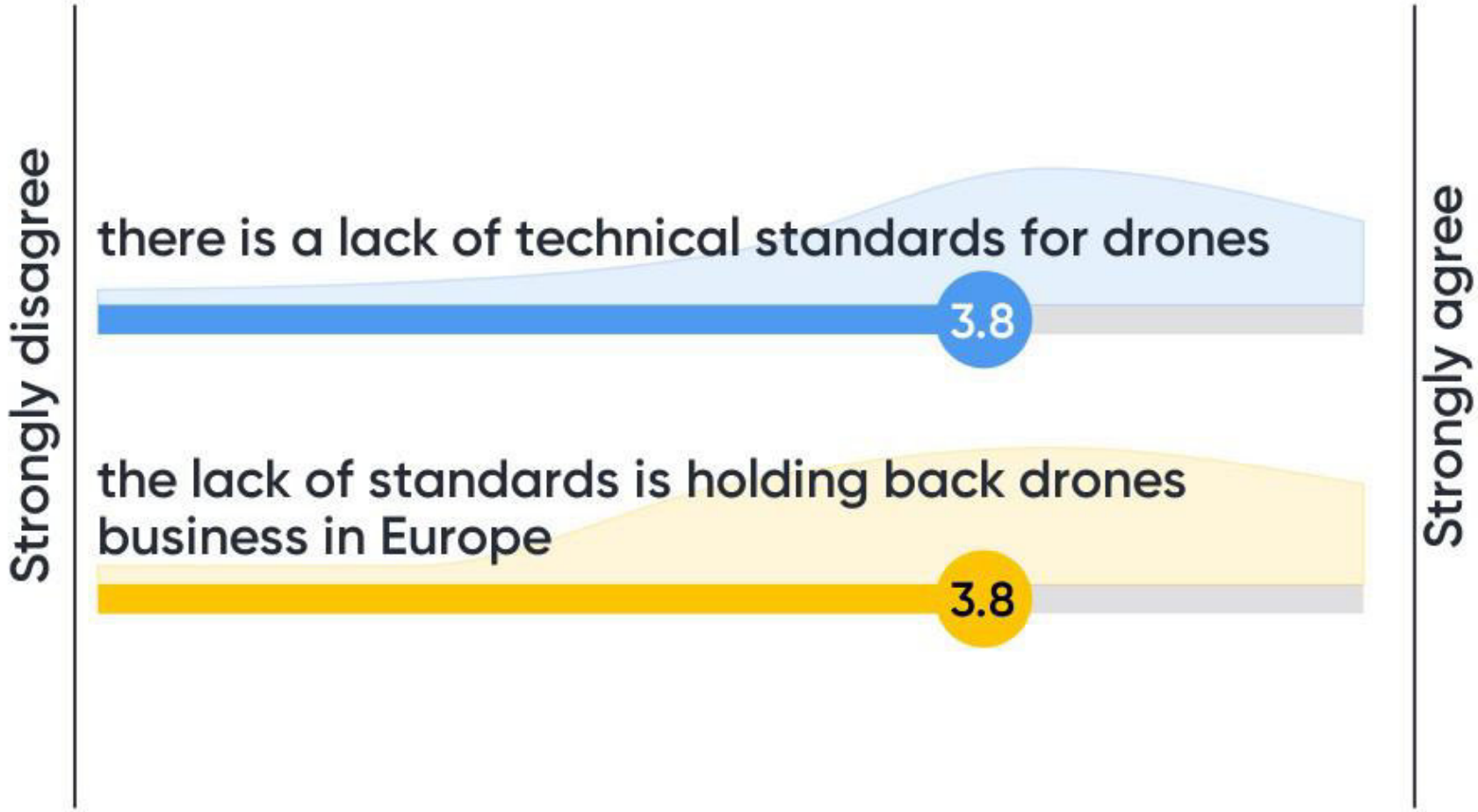
1° Interactive session and feedback collection

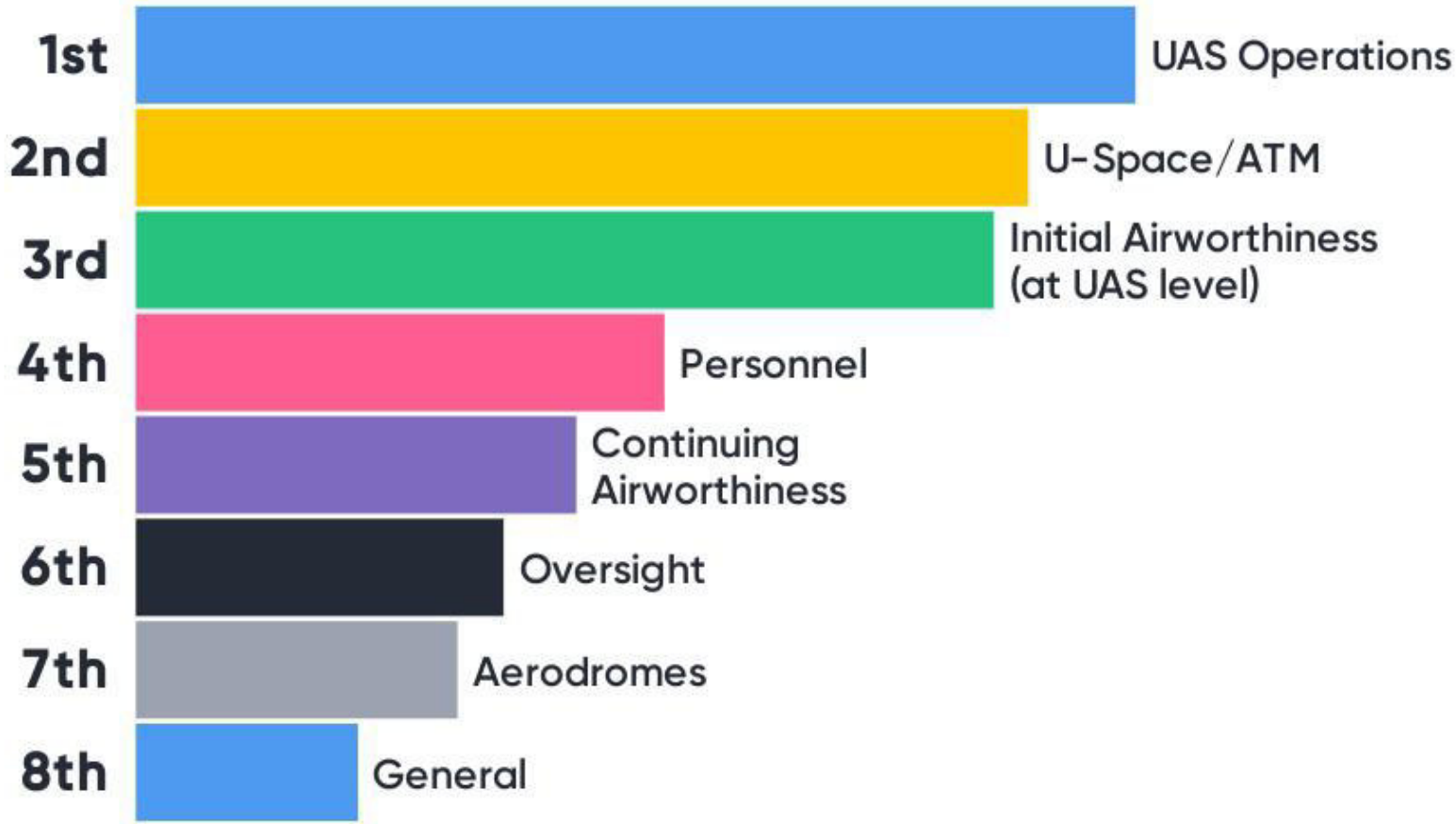
Your opinion is important:

Mentimeter



Which is the domain with the highest need for well-defined standards?

Mentimeter



Are we missing something? Suggest your domains or keywords (2 max)

Mentimeter

Is there a specific standard you would like to suggest for AW-Drones consideration?

Mentimeter

AW DRONES

Overview of mapping between standards and SORA requirements

Matteo Carta- EuroUSC Italia

Filippo Tomasello- EuroUSC Italia

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Outline

1. Methodology for the assessment of the standards
   - Assessment criteria
   - Assessment process

2. Verification of standard compliance with SORA requirements
   - Overview of the mapping process
   - Example #1: Operational Safety Objectives #9,15,22
   - Example #2: Mitigation for Ground Risk Class (M3-Emergency Response Plan)
   - Example #3: Tactical Mitigations Performance Requirements (VLOS)

3. Conclusions & Next Steps

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Methodology for the assessment of the standards

Standard collection

1	General	Definition and classificatio	X			AS6969		SAE AS-4UCS Unmanned Systems (UxS)	ongoing	This data dictionary provides a mathematically coherent set of definitions for quantity types used in data models for unmanned systems. In this data dictionary, a quantity is
2	General	Definition and classificatio		X		ARP6128	Unmanned Systems Terminology Based on the ALFUS Framework	SAE AS-4JAUS Joint Architecture for	published	This SAE Aerospace Recommended Practice (ARP) describes terminology specific to unmanned systems (UMSs) and definitions for those terms. It focuses only on terms used
3	General	Definition and classificatio	X			AS####	UAS Propulsion System Terminology	SAE E-39 Unmanned Aircraft Propulsion	planned	
4	General	Definition and classificatio				ASTM WK62416	New Standard Terminology for Unmanned Aircraft Systems	ASTM F38 Unmanned Aircraft Systems	planned	Develop a standard that presents a lexicon for unmanned aircraft systems (UAS). The Standard Terminology for Unmanned Aircraft Systems ("Standard Terminology") is
5	General	Definition and classificatio	X			ISO 21895	Requirements for the categorization and classification of civil UAS	ISO TC20/SC16/WG1	ongoing	requirements for the categorization and classification of civil UAS. The standard applies to their industrial regulation, development and production, delivery and
6	General	Definition and classificatio	X			ISO 21384-1	General requirements for UAS for civil and commercial applications, UAS terminology and classification	ISO TC20/SC16/WG1	ongoing	Provides the foundation and common terms, definitions and references relevant to the whole Standard, the purpose of which is to provide a safety quality standard for the safe
7	General	Definition and classificatio	X			ASTM WK62744	General Operations Manual for Professional Operator of Light Unmanned Aircraft Systems (UAS)	ASTM F38 Unmanned Aircraft Systems	onging	This standard defines the requirements for General Operations Manual for Professional Operator of Light Unmanned Aircraft Systems (UAS). The standard addresses
8	General	Manuals	X			ASTM WK62743	Development of Maintenance Manual for Small UAS	ASTM F38 Unmanned Aircraft Systems	onging	This specification provides the minimum requirements for a General Maintenance Manual (GMM) for an unmanned aircraft system (UAS) designed, manufactured, and
9	General	Definition and classificatio	X			ANSI/CTA - 2063	Small Unmanned Aerial Systems Serial Numbers	CTA R6 Portable Handled and In-Vehicle Electronics	published	This standard outlines the elements and characteristics of a serial number to be used by small unmanned aerial systems.

- Identified more than 600 standards developed by relevant SDOs, including **EUROCAE, ASTM, ISO, SAE, ASD-STAN**, etc.
- Both **published** and **under development** standards are considered
- List of standards for each domain reviewed with EASA experts
- Possibility to include **additional standards in next iterations** of the project

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Methodology for the assessment of the standards

The methodology for the assessment fo the standards comprises **three different cases:**

- CASE 1: Assessment of standards **potentially** suitable to comply with a certain SORA requirement (e.g. OSO #6)
- CASE 2: Assessment of the gaps (i.e. SORA requirements not covered)
- CASE 3: Assessment of standards **not mappable** with any requirement ("orphan" standard)

- Multi Criteria Analysis to address each **CASE**
- CASE 3 not addressed in the first iteration
- Today's Workshop focused on CASE 1

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Multi Criteria Analysis

- **Analytic method to compare and rank options**
- Allows to translate any assessment (qualitative or quantitative with different units of measurements) into **non-dimensional numerical scores … which can be algebraically summed**
- Scores may have different '**weight'**
- Allows to scope analysis considering **any relevant perspective**:

➢ **KPAs**
➢ **Environment**
➢ **Maturity**
➢ **Etc..**

Recommendations for Authorities/ Standard Making Bodies on the basis of the results (i.e. the weighted algebraic totals)

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CASE 1

➢ CASE 1: Assessment of standards **potentially** suitable to comply with a given SORA requirement

Criterion	Weight
Effectiveness to fulfill SORA requirement (e.g. OSO #6)	3
Maturity	1
Type of standard	1
Cost of compliance	2
Environmental impact	1
Impact on EU industry competitiveness	1
Social acceptance	1

Scoring system

Criterion X	-2	-1	0	1	2

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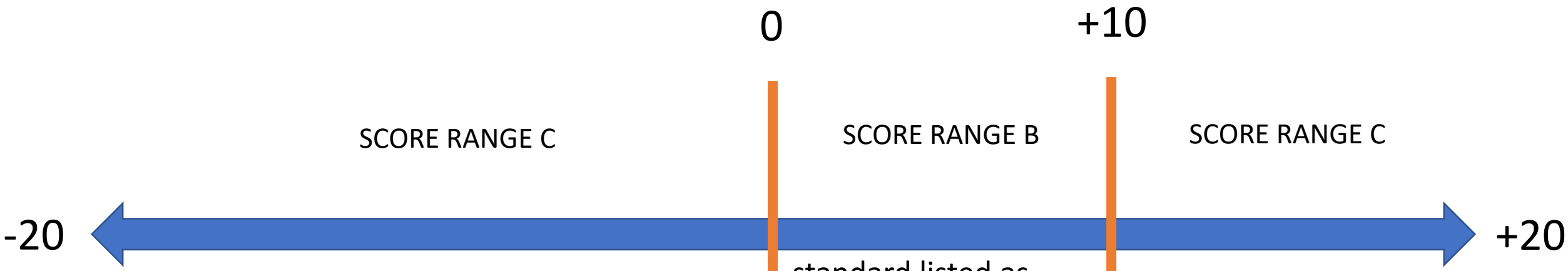
CONCLUSIONS FOR CASE 1



i. Identify possible applicable standards from other industry segments (e.g. automotive); or
ii. Recommend the amendment of the standard

standard listed as possible **acceptable mean** to comply with the requirement **on a case-by-case basis**

Standard is proposed as **preferred acceptable mean** to comply with the requirement

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Where are we now?

Criterion	Weight
Effectiveness to fulfill SORA requirement	3
Maturity	1
Type of standard	1
Cost of compliance	2
Environmental impact	1
Impact on EU industry competitiveness	1
Social acceptance	1

Mapping between standards and SORA (**v2.0**) requirements is on-going:

- **Mitigations for Ground Risk**
- **Tactical Mitigations Performance Requirements (TMPR)**
- **OSOs (Robustness up to SAIL IV)**
- **Adjacent Area/Airspace Considerations**

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Current progress

Standards assessed (either published or under development by main SDOs):

100% standards from **TC 20/SC 16**

~ **50%** Standards (most from **SC 228**)

~**80%** Standards from **WG 105**

~ **30%** Standards from F38

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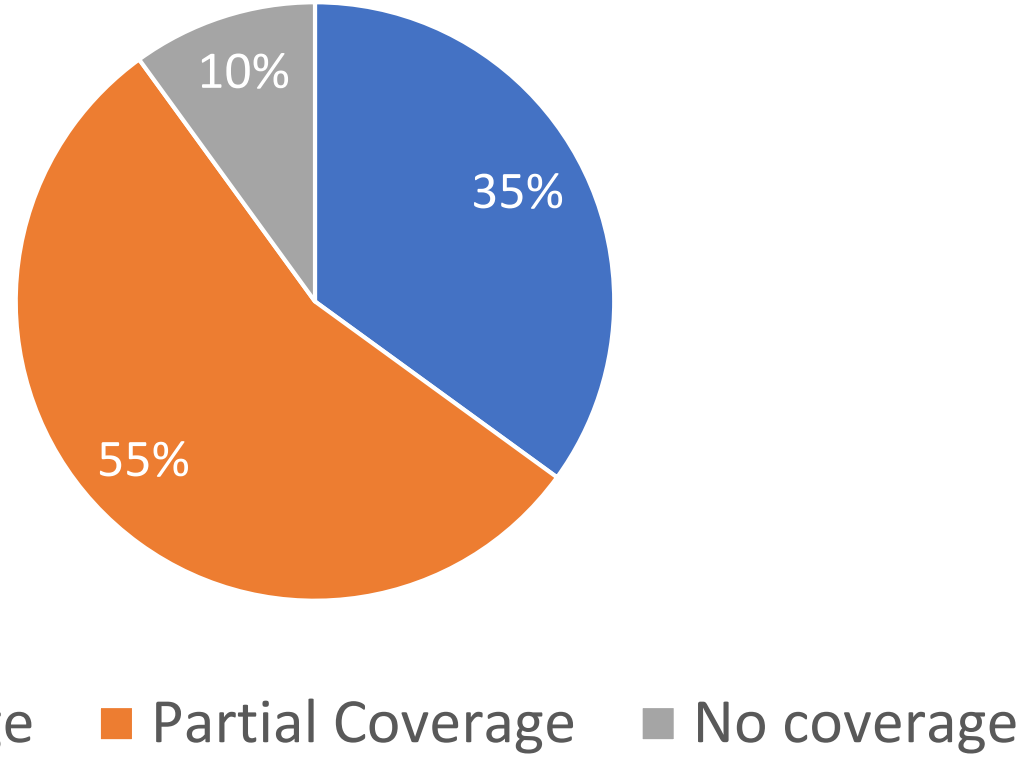
Preliminary gap analysis

Standards coverage of SORA requirements



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Mapping Example #1

OSO 9,15,22 Remote Crew training

REMOTE CREW COMPETENCIES		LEVEL of INTEGRITY		
		Low	Medium	High
OSO #09, OSO #15 and OSO #22	Criteria	The competency-based, theoretical and practical training ensures knowledge of: a) UAS regulation b) UAS airspace operating principles c) Airmanship and aviation safety d) Human performance limitations e) Meteorology f) Navigation/Charts g) UA knowledge h) Operating procedures and is adequate for the operation.[1/2]		

REMOTE CREW COMPETENCIES		LEVEL of ASSURANCE		
		Low	Medium	High
OSO #09, OSO #15 and OSO #22	Criteria	Training is self-declared (with evidence available).	• Training syllabus is available. • The operator provides competency-based, theoretical and practical training.	A competent third party: • Validates the training syllabus. • Verifies the remote crew competencies.

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Mapping Example #1

OSO 9,15,22 Remote Crew training

Main standards assessed:

Organisation	WG	#	Title
SAE	G-30	ARP 5707	Pilot Training Recommendations for UAS Civil Operations
ASTM	F-38	F3266-18	Standard Guide for Training for Remote Pilot in Command of UAS Endorsement
ISO	TC20/SC16 (WG3)	ISO 23665	Unmanned aircraft systems -Training for personnel involved in UAS operations
JARUS	WG1	-	JARUS Recommendation for remote PILOT COMPETENCY (RPC) for UAS OPERATIONS in category A (OPEN) and category B (specific) + GM on RAE (Recognised Assessment Entity)
ASTM	F-38	F3330-18	Standard Specification for Training and the Development of Training Manuals for the UAS Operator

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Mapping Example #1

	Low	Medium	High
Integrity	Full (only RP)		
Assurance		Partial	Partial

JARUS recommendation for remote pilot competency (RPC) for UAS operations in Category A and B

Status:
Draft post ext. consul.

Remarks:

- Developed hoc by JARUS to cover OSO 9,15,22 requirements
- Includes training syllabus for RP in **VLOS** and **BVLOS**
- **Easily Complemented** by GM for the Recognised Assessment Entity (RAE) for the assurance part.

Gaps:

- Not covering training of other remote crew members (VO, Payload operator)

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Mapping Example #1

	Low	Medium	High
Integrity	No coverage		
Assurance		Full	Full

JARUS guidance material on JARUS recommendation UAS RPC CAT A and CAT B regarding RAE

Status:
Final draft under ballot until 22 Sept.

Remarks:

- Defines requirements for a RAE (**Recognised assessment entity**)
- RAE is an entity recognised by the competent authority as a provider for theoretical knowledge examination and practical skill assessment as described in Article 3 (c) of the JARUS Recommendation UAS RPC Cat A and Cat B.

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Mapping Example #1

	Low	Medium	High
Integrity	Full (only RP)		
Assurance		Full	Partial

ISO 23665 Training for personnel involved in UAS OPS

Status: Draft (CD)

Remarks:

- Full coverage of all integrity requirements in relation to Remote Pilots
- Very comprehensive and detailed training syllabus
- Provides requirements for training organization
- **Planned to include annexes covering other remote crew members**

Gaps:

- Current version not covering training of other remote crew members (e.g. VO, Payload operator)
- Current version only limited to VLOS conditions (further Annex to cover BVLOS is expected)

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Mapping Example #1

	Low	Medium	High
Integrity	Partial		
Assurance		Partial	Partial

ARP 5707

Pilot training recommendations for UAS civil operations

Status: Published

Remarks:

- Training for RP operating in the NAS
- Training syllabus developed following manned aviation models (PPL and CPL)

Gaps:

- Only requirements for practical training
- Training requirements limited to rotary wing aircraft
- No requirements for VOs, payload operators, etc
- Distinction between VFR and IFR flights (not VLOS/ BVLOS)
- No requirements for the training organisation

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Mapping Example #1

	Low	Medium	High
Integrity	Full (only RP)		
Assurance		Partial	No coverage

3266-18

Standard guide for Training for Remote Pilot in Command of UAS Endorsement

Status: Published

Remarks:

- Full coverage of all integrity requirements for Remote Pilots
- Contains a schematic training syllabus

Gaps:

- Not covering training of other remote crew members (VO, Payload operator)
- Not much details about Emergency/contingency procedures
- No distinction between VLOS and BVLOS conditions
- No requirements for the training organisation

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Mapping Example #1

	Low	Medium	High
Integrity	No coverage		
Assurance		Full	Partial

F3330-18

Standard specification for Training and the development of Training Manuals for the UAS operator

Status: Published

Remarks:

- Well-structured guidance to develop an operator training program
- Potentially suitable for any kind of UAS (up to 600 kg) and operation
- May constitute evidence of competency-based training

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Mapping Example #1

Conclusions: OSO 9,15,22 Remote Crew training

- The **combination** of JARUS recommendations for RPC and JARUS GM for RAE identified as the **best standard** to cover OSOs 9,15,22
- ISO 23665 (still under development) is also a **good** candidate to meet OSO requirements (**new annexes expected to cover gaps**)
- A general gap is **absence** of training requirements for remote crew members other than Remote pilot

Further standards to be monitored:

ASTM F38: **WK62741 New Guide for Training UAS Visual Observers**

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Mapping Example #2

M3 Emergency Response Plan (Integrity)

		LEVEL of INTEGRITY		
		Low/None	**Medium**	**High**
M3 - An Emergency Response Plan (ERP) is in place, operator validated and effective	Criteria	No ERP is available, or the ERP does not cover the elements identified to meet a "Medium" or "High" level of integrity	The ERP: • is suitable for the situation; • limits the escalating effects; • defines criteria to identify an emergency situation; • is practical to use; • clearly delineates Remote Crew member(s) duties.	Same as Medium. In addition, in case of loss of control of the operation, the ERP is shown to significantly reduce the number of people at risk although it can be assumed that a fatality may still occur.
	Comments	*N/A*	*N/A*	*N/A*

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Mapping Example #2

M3 ERP (Assurance criterion #1: procedures)

	LEVEL of ASSURANCE		
	Low/None	**Medium**	**High**
Criterion #1 (Procedures)	• Procedures do not require validation against either a standard or a means of compliance considered adequate by the competent authority. • The adequacy of the procedures and checklists is declared.	• The ERP is developed to standards considered adequate by the competent authority and/or in accordance with means of compliance acceptable to that authority[1]. • The ERP is validated through a representative tabletop exercise[2] consistent with the ERP training syllabus.	Same as Medium. In addition: • The ERP and the effectiveness of the plan with respect to limiting the number of people at risk are validated by a competent third party. • The applicant has coordinated and agreed the ERP with all third parties identified in the plan. • The representativeness of the tabletop exercise is validated by a competent third party.

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Mapping Example #2

M3: ERP (Assurance criterion #2: Training)

	LEVEL of ASSURANCE		
	Low/None	**Medium**	**High**
Criterion #2 (Training)	Does not meet the "Medium" level criterion	• An ERP training syllabus is available. • A record of the ERP training completed by the relevant staff is established and kept up to date.	Same as Medium. In addition competencies of the relevant staff are verified by a competent third party.

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Mapping Example #2

M3 ERP

Main standards assessed:

Organisation	WG	#	Title
ASTM	F38	F3266	ASTM F3266: Standard Guide for Training for Remote Pilot in Command of Unmanned Aircraft Systems (UAS) Endorsement
ISO	TC20/SC16	21384-3	UAS Operational procedures
ISO	TC20/SC16	23665	Training for UAS personnel
ISO	TC 283	45001	Occupational health and safety management systems -- Requirements with guidance for use
IATA	IATA (ERP) Task Force	-	Emergency Response Handbook

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Mapping Example #2

Conclusions: M3 ERP

Int/Ass	Requirement	ASTM F-3266	ISO 21384-3	ISO 23665	ISO 45001	IATA ERP
Integrity	ERP Suitable for the situation (UAS OPS)	X	✓	✓	X	X
	ERP Practical to use	X	X	X	X	✓
	Criteria to define emergency situations	X	X	✓	✓	✓
	Remote Crew duties	X	X	X	X	X
	Criteria for reduction of people at risk	X	X	X	X	X
Assurance	Training syllabus	✓	X	✓	✓	X

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Mapping Example #3

TMPR: VLOS/EVLOS conditions

Requirement 1 (De confliction scheme): The operator should produce a documented VLOS de-confliction scheme, explaining the methods that will be applied for detection and the criteria used to avoid incoming traffic.

Requirement 2 (Phraseology, procedures and protocols): If the remote pilot relies on detection by observers, the use of communication phraseology, procedures, and protocols should be described. Since the VLOS operation may be sufficiently complex a requirement to document and approve the VLOS strategy is necessary before authorization and approval by the competent authority and/or ANSP.

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Mapping Example #2

Conclusions: TMPR (VLOS/EVLOS)

General Remarks on **Requirement 1**:

- **No standards** providing a de-confliction scheme

General Remarks on **Requirement 2**:

- Available standards providing guidance on phraseology and communication procedures in aviation but **not specific for UAS OPS**

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Conclusions

- **Mapping with SORA requirements**:
  - Identified a set of standards covering SORA reqs.
  - Analysis considers both published and on-going standards
  - Main gaps highlighted (e.g. requirements not covered at all)

- **Next Steps**:
  - Consolidate gap analysis (checking ASTM, SAE or other standards)
  - Assess standards on the basis of other criteria (environment, social acceptance, maturity, type, etc..)

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AW DRONES

Thanks for your attention !

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Mapping Example #2

	Medium	High
Integrity	No coverage	No coverage
Assurance (Training)	Full	

3266-18

Standard guide for Training for Remote Pilot in Command of UAS Endorsement

Status: Published

Remarks:

- Provides Training syllabus dealing with emergency procedures

Gaps:

- Does not provide guidance on the ERP preparation

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Mapping Example #2

	Medium	High
Integrity	Partial	Partial
Assurance (Training)	No coverage	

ISO 21384-3 Operational procedures

Status: Draft (FDIS)

Remarks:

- High level guidance on basic operational procedures in case of emergency (including communication with external entities and predisposition of emergency equipment)

Gaps:

- Criteria to define emergency situations not provided
- Absence of a template for the ERP (template=practical to use)
- No clear definition of remote crew duties
- No criteria to demonstrate that the number of people at risk is reduced

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Mapping Example #2

	Medium	High
Integrity	Partial	Partial
Assurance (Training)	Full	

ISO 23665 Training for personnel involved in UAS OPS

Status: Draft (CD)

Remarks:

- Guidance on the ERP content, including classification of emergency actions, procedures in case of loss of control, etc.

Gaps:

- Criteria to define emergency situations not provided
- Absence of a template for the ERP (template=practical to use)
- No clear definition of remote crew duties
- No criteria to demonstrate that the number of people at risk is reduced

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Mapping Example #2

	Medium	High
Integrity	Partial	Partial
Assurance (Training)	Partial	

ISO 45001 Occupational Health and Safety

Status: Published

Remarks:

- Includes guidance on how to compile an ERP for a generic activity
- General criteria to define emergency conditions are defined

Gaps & remarks:

- Emergency conditions and responsibilities not tailored for UAS OPS
- ERP Training activities not specific for UAS OPS

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Mapping Example #2

	Medium	High
Integrity	Partial	Partial
Assurance (Training)	No coverage	

IATA

Emergency Response Handbook

Status: Published

Remarks:

- First document of its kind to provide a practical ERP template
- ERP specific air carrier operators
- Roles and responsibilities defined for the ERT (Emergency Response Team)

Gaps:

- Duties not immediately applicable for remote crew
- Criteria to define emergency situations are provided but not tailored for UAS
- No criteria to demonstrate that the number of people at risk is reduced

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

Gap analysis (F=Full, P=Partial, N=No coverage)

GRC Mitigations	Coverage
M1	P
M2	P
M3	P

Tactical Mitigations	Coverage
VLOS	N
BVLOS	F

Adj airsp./area	Coverage
Adj. airspace req.	F

OSO	Coverage	OSO #	Coverage
# 1	P	# 10/12	F
# 2	P	# 13	P
# 3	F	# 16	P
# 4	P	# 17	N
# 5	P	# 18	P
#6	F	# 19	P
# 7	F	# 20	P
# 8/11/14/21	F	# 23	P
# 9/15/22	F	# 24	F

This project has received funding from European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No°824292.

AW DRONES

2° Interactive sessions and feedback collection

Your opinion is important

Mentimeter

Are we missing any important criterion?

Mentimeter

How would you weigh the assessment criteria?

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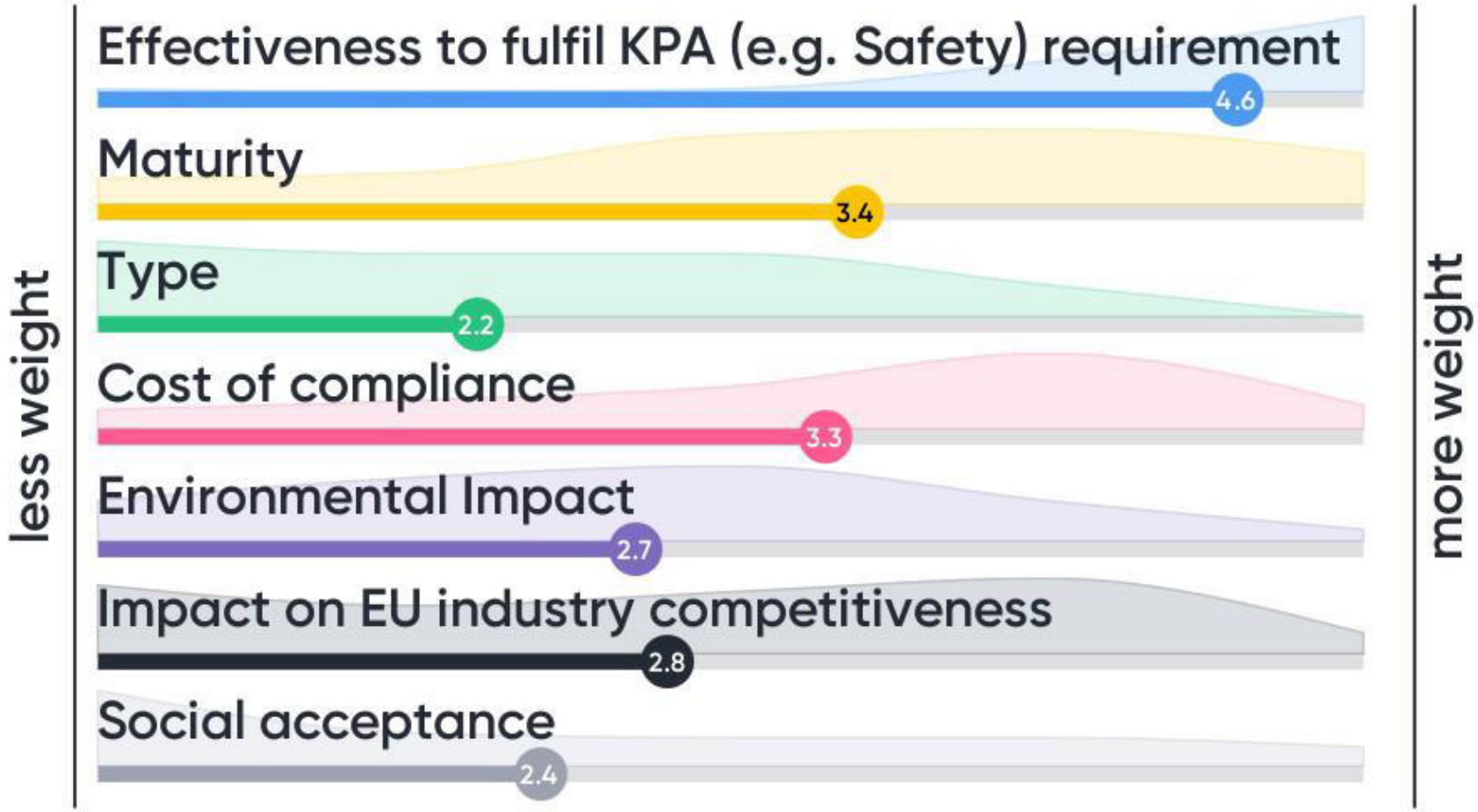

ANSI Unmanned Aircraft Systems Standardization Collaborative (UASSC)

A Roadmap for Standards

VERSION 2.0 Project Overview

Philip M. Kenul

ASTM F38 Committee Chair

Why a Roadmap? Many Standards Developing Organizations (SDOs) Involved in UAS

ASTM International

International Organization for Standardization

RTCA, Inc.

SAE International

Institute of Electrical and Electronics Engineers

Consumer Technology Association

Open Geospatial Consortium

Underwriters Laboratories Inc.

National Fire Protection Association

American Society of Mechanical Engineers

American Society of Safety Professionals

Telecommunications Industry Assn.

ANSI

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May 19, 2017 ANSI UAS Standardization Coordination Meeting

- 42 organizations including industry, trade associations, SDOs, federal agencies, coalitions, academia, et al.
- Proposed UASSC mission, objectives, deliverables, current standards, focus

September 28, 2017 UASSC Kick-off Meeting

- 83 attendees from 58 organizations including industry, trade associations, SDOs, government and others
- Approved UASSC mission, objectives and deliverables

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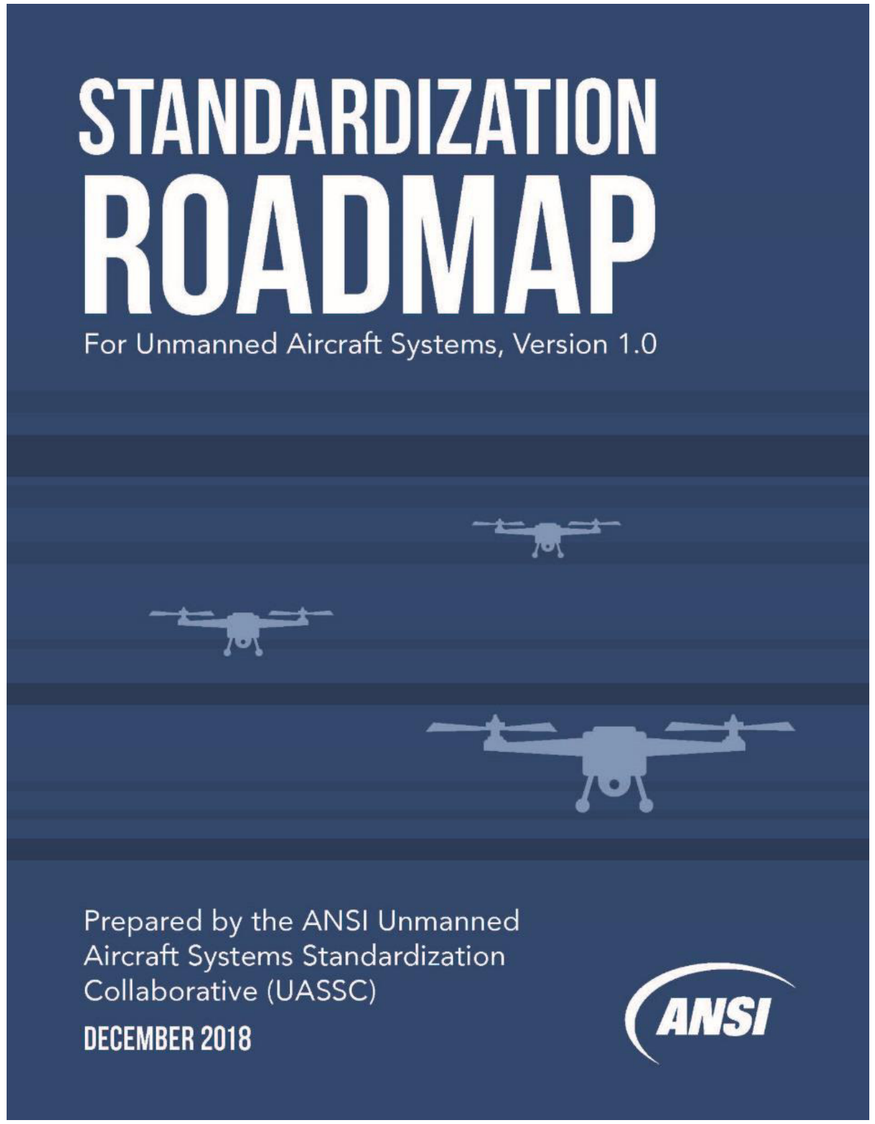
Mission and Deliverable

- **Mission:** To coordinate and accelerate the development of the standards and conformity assessment programs needed to facilitate the safe integration of unmanned aircraft systems (UAS) into the national airspace system (NAS) of the United States, with international coordination and adaptability
- **Deliverable:** A comprehensive roadmap published in December 2018 describing the current and desired standardization landscape for UAS
  - Available as a free download at www.ansi.org/uassc



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Structure and Participation

- Steering Committee
- WG1 – Airworthiness
- WG2 – Flight Operations and Personnel Qualifications
- WG3 – Infrastructure Inspections and Commercial Services Operations
- WG4 – Public Safety Operations
- Participation open to UAS stakeholders that have U.S. operations
  - ANSI membership not a prerequisite
  - Participants come from industry, government agencies, standards developing organizations (SDOs), and other interested stakeholders
  - **Over 300 individuals from some 175 public- and private-sector organizations** supported the roadmap's development

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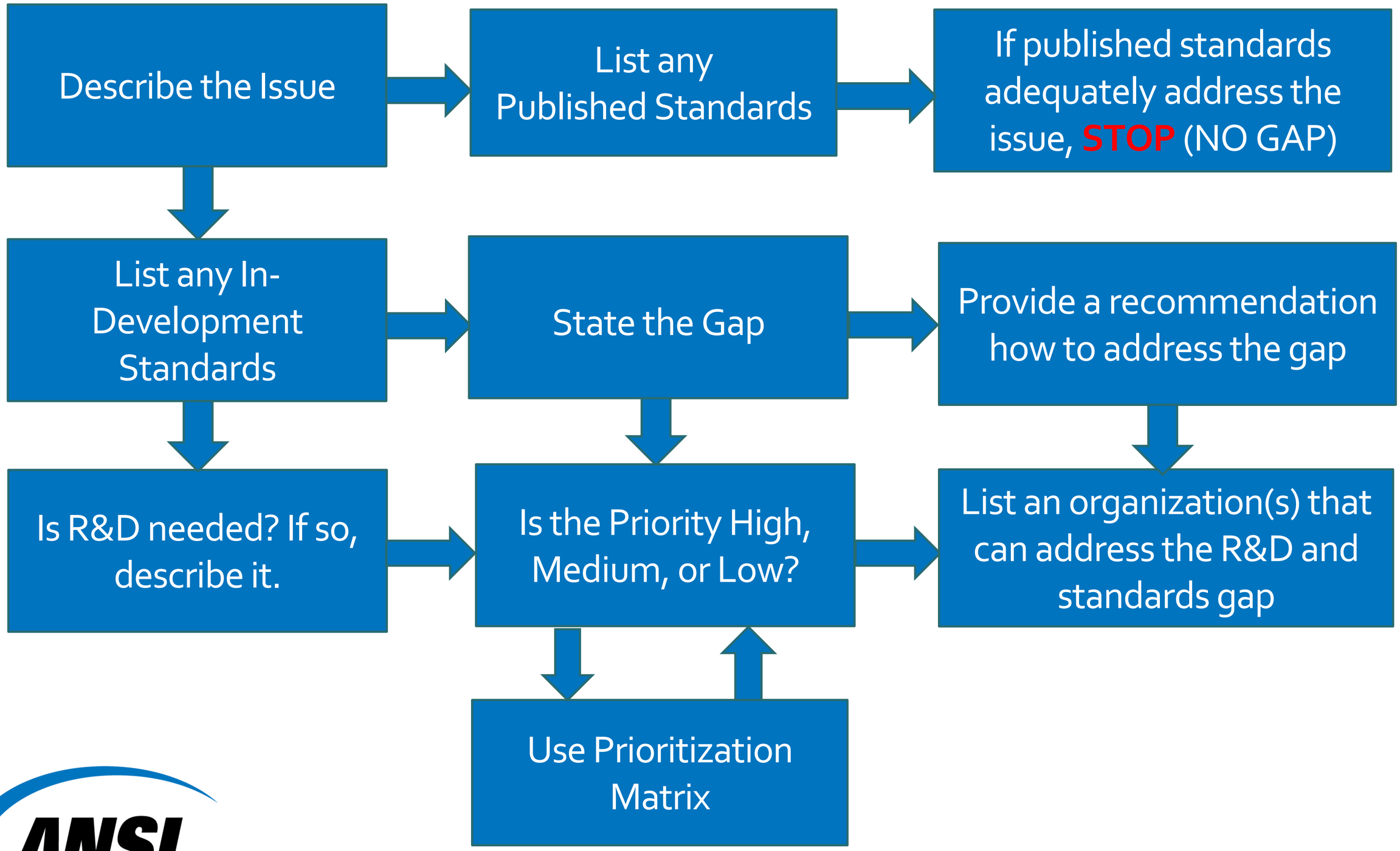
WGs' Approach to Gap Analysis



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Sample Gap Statement

- **Gap: Crane Inspection Using UAS**. Standards are needed to cover requirements for the use of UAS in the inspection, testing, maintenance and operation of cranes and other material handling equipment covered within the scope of ASME's B30 volumes.
- **R&D Needed:** No
- **Recommendation:** Complete work on ASME B30.32 to address crane inspections using UAS.
- **Priority:** Medium*
- **(NEW) Status of Progress:** Options: Closed (completed), Green (moving forward), Yellow (delayed), Red (at a standstill), Not Started, Withdrawn, or Unknown
- **(NEW) Update:** Narrative statement summarizing any significant changes from version 1
- **Organization:** ASME

* For any NEW gaps refer to prioritization matrix on next two slides

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Prioritization Matrix: Making the CASE for the Gap Priority Level

Criteria

- **Criticality (Safety/Quality Implications)** How important is the project? How urgently is a standard or guidance needed? What would be the consequences if the project were not completed or undertaken? A high score means the project is more critical.
- **Achievability (Time to Complete)** - Does it make sense to do this project now, especially when considered in relation to other projects? Is the project already underway or is it a new project? A high score means there's a good probability of completing the project soon.

Scoring Values

- 3 - critical
- 2 - somewhat critical
- 1 - not critical

- 3 - project near completion
- 2 - project underway
- 1 - new project

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Prioritization Matrix (contd.)

Criteria

- **Scope (Investment of Resources)** - Will the project require a significant investment of time/work/money? Can it be completed with the information/tools/resources currently available? Is pre-standardization research required? A high score means the project can be completed without a significant additional investment of resources.
- **Effect (Return on Investment)** - What impact will the completed project have on the industry? A high score means there are significant gains for the industry by completing the project.

Scoring Values

- 3 - low resource requirement
- 2 - medium resource requirement
- 1 - resource intensive

- 3 - high return
- 2 - medium return
- 1 - low return

Score Rankings

- High Priority (a score of 10-12)
- Medium Priority (a score of 7-9)
- Low Priority (a score of 4-6)

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Roadmap Gaps Breakdown

Section	High (0-2 years)	Medium (2-5 years)	Low (5+ years)	Total
WG1 Airworthiness	16	2	1	19
WG2 Flight Operations	8	2	1	11
WG3 Infrastructure Inspections/ Commercial Svcs	4	7	1	12
WG4 Public Safety Operations	4	5	0	9
WG2 Personnel Qualifications	8	1	0	9
Total	40	17	3	60

36 gaps need Research & Development

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Goals for Version 2

- Expand topics covered
  - spectrum, urban air mobility, and recreational operations
- Bring in subject matter experts not previously involved
- Identify potentially overlooked issues and gaps
- Track progress to address the roadmap recommendations, including new or completed work
- Review priorities, noting steering committee rankings of high priority gaps
- Incorporate participant feedback and update the document as appropriate
- Publish roadmap version 2.0 end of June 2020

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VERSION 2 : Breakout Groups - Questions

Questions Related to the Roadmap and Roadmap Update

- What are the top UAS issues of concern for your organization?
- What issues, activities, or initiatives are missing from the roadmap or not adequately covered in your view?
- Please provide any comments that you have on the roadmap's organization.
- Who is not here today who should be involved in this effort?

Questions Related to UAS Standardization

- What topics are not being adequately addressed in UAS standardization?
- What overlap or duplication exists in UAS standardization?

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TIME-LINE VERSION 2 KICK-OFF SEPTEMBER 13 WASHINGTON DC

- Steering Committee Call (Sep 19 from 3-4pm)
- Resume twice monthly WG calls (Oct 2019 – Mar 2020)
  - Provide updates on gaps and to text
  - Discuss new areas and draft text as needed
- Public review of roadmap draft version 2.0 (Apr 2020)
- Reconvene WGs to dispose of comments (May 2020)
- Final copy edit / Publish roadmap version 2.0 (June 2020)
- Promote roadmap thereafter
- More Info at www.ansi.org/uassc

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For More Information

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BACK UP SLIDES

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Working Group 1 – Airworthiness (Roadmap Chapter 6)

- Design and Construction
- Safety
- Quality Assurance/Quality Control
- Avionics and Subsystems
- Command and Control Link
- Navigational Systems
- Detect and Avoid Systems
- Software Dependability and Approval
- Crash Protected Airborne Recorder Systems
- Cybersecurity
- Electrical Systems
- Power Sources and Propulsion Systems
- Noise, Emissions, and Fuel Venting
- Mitigation Systems for Various Hazards
- Parachutes for sUAS
- Maintenance and Inspection
- Enterprise Operations: Level of Automation/Autonomy/ Artificial Intelligence (AI)
- **Spectrum (new)**

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Working Group 2 – Flight Operations: General Concerns and Personnel Qualifications (Roadmap Chapters 7 & 10)

- Privacy
- Operational Risk Assessment
- Beyond Visual Line of Sight
- Operations Over People
- Weather
- Data Handling & Processing
- UAS Traffic Management
- Remote ID & Tracking
- Geo-fencing
- Terminology
- Manuals
- UAS Flight Crew
- Additional Crew Members
- Maintenance Technicians
- Compliance/Audit Programs
- Human Factors in UAS Operations

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Working Group 3 – Infrastructure Inspections and Commercial Services Operations (Roadmap Chapter 8)

- Vertical Infrastructure Inspections
  - Boilers & Pressure Vessels
  - Cranes
  - Building Facades
  - Low-Rise Residential and Commercial Buildings
  - Communications Towers
- Linear Infrastructure Inspections
  - Bridges
  - Railroads
  - Power Transmission Lines
- Wide Area Environment Infrastructure Inspections/Precision Agriculture
  - Environmental Monitoring
  - Pesticide Application
  - Livestock Monitoring and Pasture Management
- Commercial Package Delivery
- Occupational Safety Requirements for UAS Operated in Workplace
- **Urban Air Mobility (new)**

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Working Group 4 – Public Safety Operations (Roadmap Chapter 9)

- sUAS for Public Safety Operations
- Hazardous Materials Incident Response and Transport
- Transport and Post-Crash Procedures Involving Biohazards
- Forensic Investigations Photogrammetry
- Payload Interface and Control for Public Safety Operations
- Search and Rescue
  - sUAS FLIR Cameral Sensor Capabilities
  - sUAS Automated Waypoint Missions
- Response Robots
- Law Enforcement Tactical Operations
- Counter UAS
- **Recreational Operations (new)**

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Steering Committee Survey to Rank 40 High Priority Gaps
Tier 1 – Most Critical (14)

- Gap A1: UAS Design and Construction (D&C) Standards
- Gap A5: Command and Control (C2)/Command, Control and Communications (C3) Link Performance Requirements
- Gap A7: UAS Navigational Systems
- Gap A8: Protection from Global Navigation Satellite Signals (GNSS) Interference Including Spoofing and Jamming
- Gap A9: Detect and Avoid (DAA) Systems
- Gap A10: Software Dependability and Approval
- Gap A12: UAS Cybersecurity
- Gap O2: Operational Risk Assessment and Risk Mitigation
- Gap O3: Beyond Visual Line of Sight (BVLOS)
- Gap O4: UAS Operations Over People (OOP)
- Gap O8: Remote ID and Tracking: Direct Broadcast
- Gap O9: Remote ID and Tracking: Network Publishing
- Gap S9: Counter-UAS/Drone (C-UAS) Operations
- Gap P8: Flight Control Automation and System Failures

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Survey to Rank High Priority Gaps (contd.)
Tier 2 – Critical (14)

- Gap A4: Avionics and Subsystems
- Gap A6: Technical support for C2/C3 link performance requirements in telecommunications standards
- Gap A16: Mitigation Systems for Various Hazards
- Gap A18: Maintenance and Inspection (M&I) of UAS
- Gap A19: Enterprise Operations: Levels of Automation/ Autonomy/ Artificial Intelligence (AI)
- Gap O5: UAS Operations and Weather
- Gap O7: UTM Service Performance Standards
- Gap O10: Geo-fence Exchange
- Gap I12: Occupational Safety Requirements for UAS Operated in Workplaces
- Gap S1: Use of sUAS for Public Safety Operations
- Gap P2: Manuals (tie tier 2/3)
- Gap P3: Instructors and Functional Area Qualification
- Gap P5: UAS Maintenance Technicians
- Gap P9: Crew-Composition, Selection, and Training (tie tier 2/3)

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Survey to Rank High Priority Gaps (contd.)
Tier 3 – Least Critical (12)

- Gap A13: Electrical Systems
- Gap A14: Power Sources and Propulsion Systems
- Gap A15: Noise, Emissions, and Fuel Venting
- Gap A17: Parachute or Drag Chute as a Hazard Mitigation System in UAS Operations over People (OOP)
- Gap I9: Inspection of Power Transmission Lines Using UAS
- Gap I10: Pesticide Application Using UAS
- Gap I11: Commercial Package Delivery
- Gap S3: Transport and Post-Crash Procedures Involving Biohazards
- Gap S5: Payload Interface and Control for Public Safety Operations
- Gap P1: Terminology
- Gap P6: Compliance and Audit Programs
- Gap P7: Displays and Controls

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EASA
European Aviation Safety Agency

EUSCG

The EASA Team

TE.GEN.00409-001

Your safety is our mission.

An agency of the European Union

Standardisation bodies

ASD-STAN Standardization

SAE INTERNATIONAL

EUROCAE

ISO

ASTM INTERNATIONAL Helping our world work better

CEN CENELEC

Global UTM Association

EUROCONTROL

ETSI World Class Standards

Standards

Chaired by Eurocae

EUSCG

- https://www.euscg.eu/

Rollout Development Plan

Aim: List all available standards and link to the regulatory requirements

EASA
European Aviation Safety Agency

Questions and comments welcome

Your safety is our mission.

An agency of the European Union

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Final feedback

Please share your feedback about today

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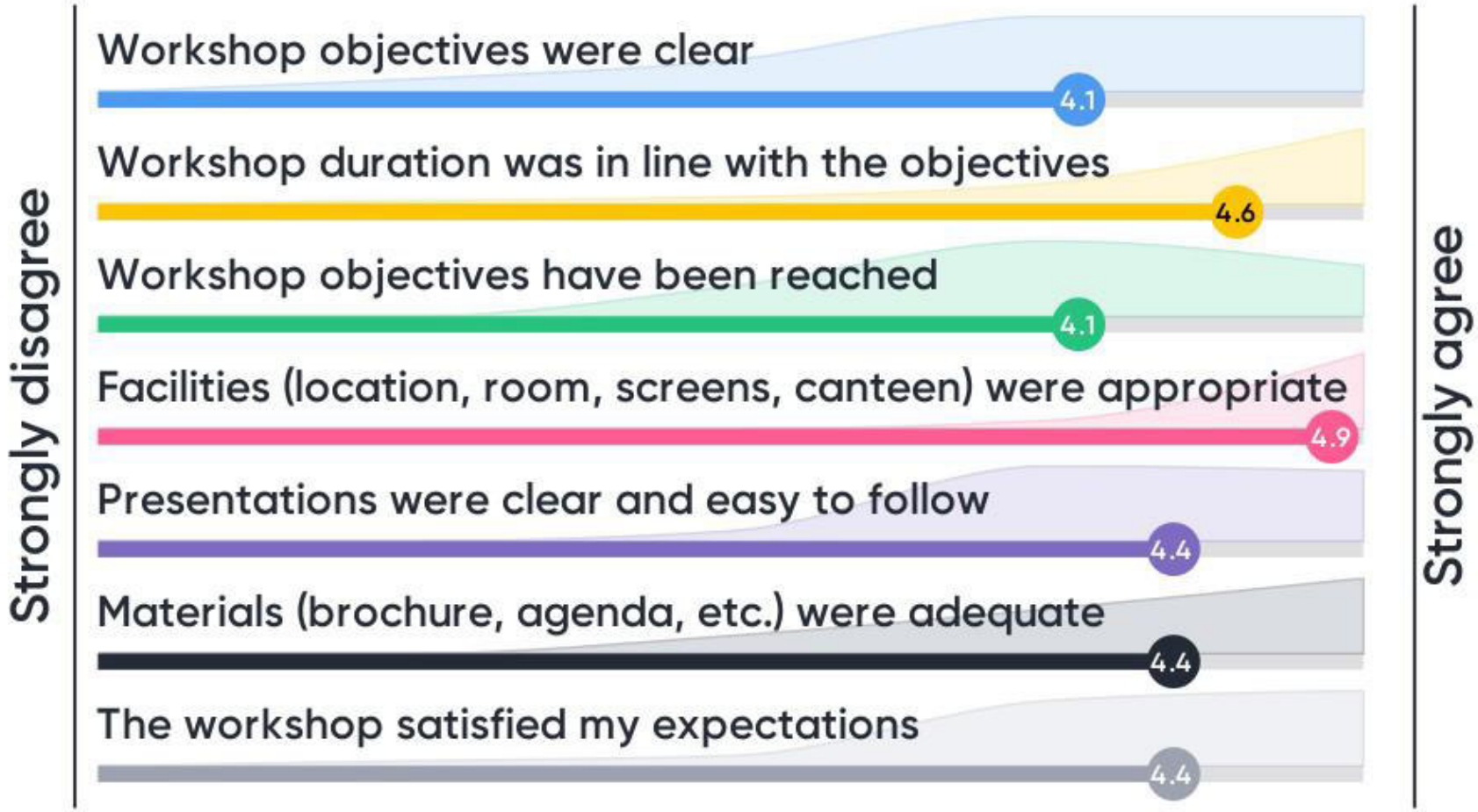

Please share your thoughts about the next steps

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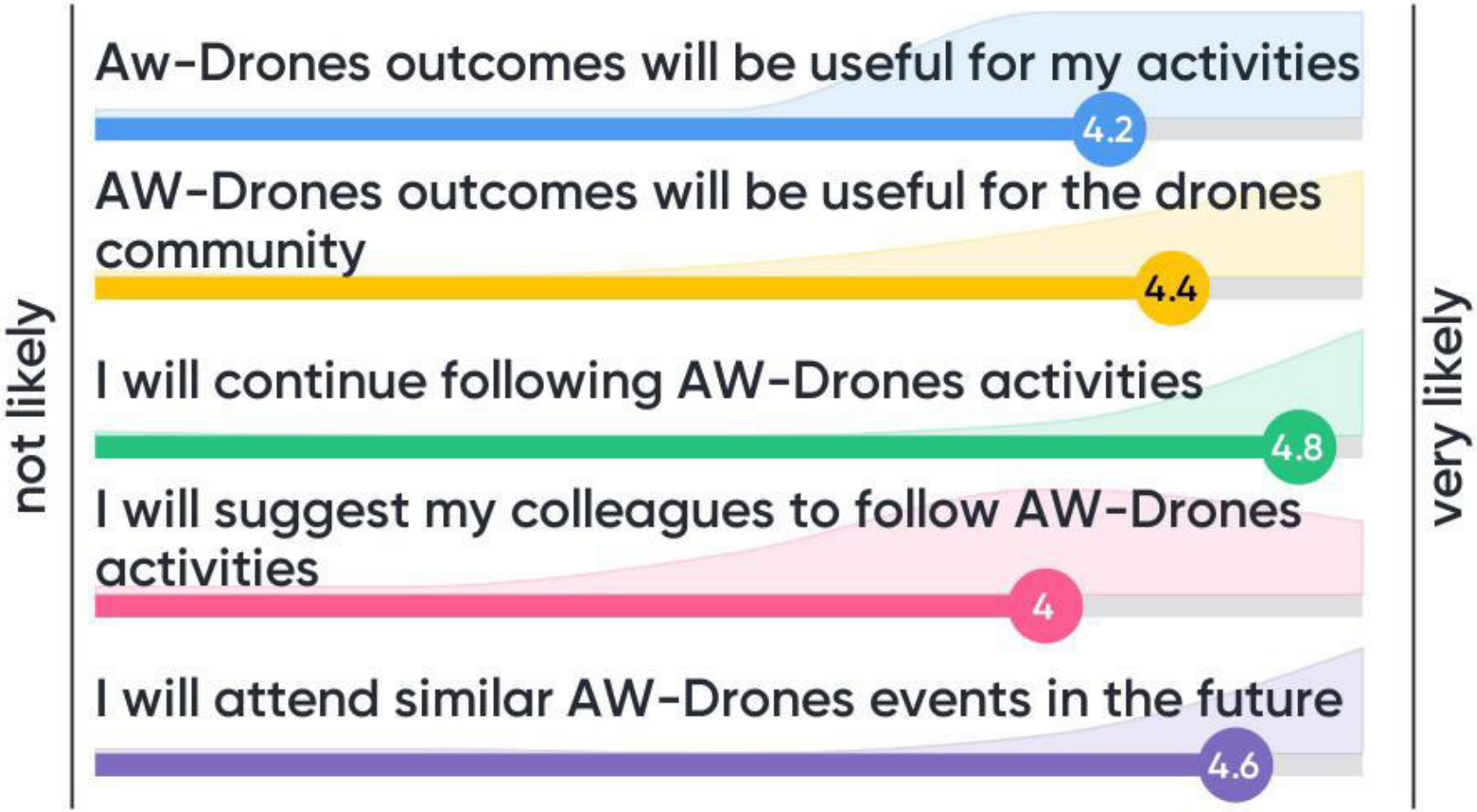

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